

BEST MANAGEMENT PRACTICES for



**Erosion Control
on
Timber Harvesting
Operations
in
New Hampshire**

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Prepared By: J.B. Cullen
State of New Hampshire
Department of Resources and Economic Development
Division of Forests and Lands
Forest Information and Planning Bureau
<http://dred.state.nh.us/forlands>

In cooperation with:



Resources Program

Room 214 - Nesmith Hall
131 Main Street, UNH
Durham, NH 03824-3597
<http://ceinfo.unh.edu>

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For more copies, contact:
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INTRODUCTION

Every timber harvesting operation involves some risk of soil erosion and sedimentation that may affect water quality. With a common understanding of the risks and through the use of this publication, the forest industry, landowners, and the government working together can protect our state's water resources.

This publication is primarily a reference and training tool designed to help foresters and loggers become better informed about the best management practices for reducing soil erosion and controlling sedimentation from timber harvesting activities.

When using this publication, it is important to remember that for every situation encountered, there may be more than one correct method to prevent erosion and sedimentation. Flexibility and understanding are important, since the intent of any best management practice is to **keep sediment out of the streams**.

ACKNOWLEDGEMENT

The author has drawn freely from the publications listed in the reference section and received assistance and suggestions from county, state, and federal foresters as well as the forest industry. The reader is urged to consult these publications if detailed information beyond the scope of this publication is desired. When needed, help and advice for the implementation of the Best Management Practices can be obtained from any of the agencies listed in the Available Assistance Section. Your comments about this publication are welcome.

Assistance in the preparation of this publication was contributed by:

- State of New Hampshire - Department of Resources & Economic Development
Division of Forests and Lands
- State of New Hampshire - Department of Environmental Services
Water Supply and Pollution Control Division
Water Resources Division
Wetlands Bureau
- University of New Hampshire Cooperation Extension
- USDA - Natural Resource Conservation Service
- USDA - Forest Service - White Mountain National Forest
- USDA - Forest Service - State and Private Forestry
- New Hampshire Timberland Owners' Association
- Numerous professional loggers and foresters who have reviewed drafts

DEFINITIONS

Best Management Practices - Proper methods for the control and dispersal of water on truck roads, skid trails, and log landings to minimize erosion and reduce sediment and temperature changes in streams.

Bog - A low-lying area with standing water or saturated soil for a significant portion of the year that is dominated by grass-like vegetation, shrubs and dwarf trees and which has a thick vegetative mat under foot.

Erosion - Wearing away of the surface of the land, by action of water or wind due to timber harvesting operations.

Facultative Species: Trees and shrubs that are equally likely to occur in wetlands or uplands (estimated probability 34-66%).

Facultative Upland Species: Trees and shrubs that usually occur in uplands (non-wetlands) (estimated probability 67-99%), but occasionally found in wetlands (estimated probability 1-33%).

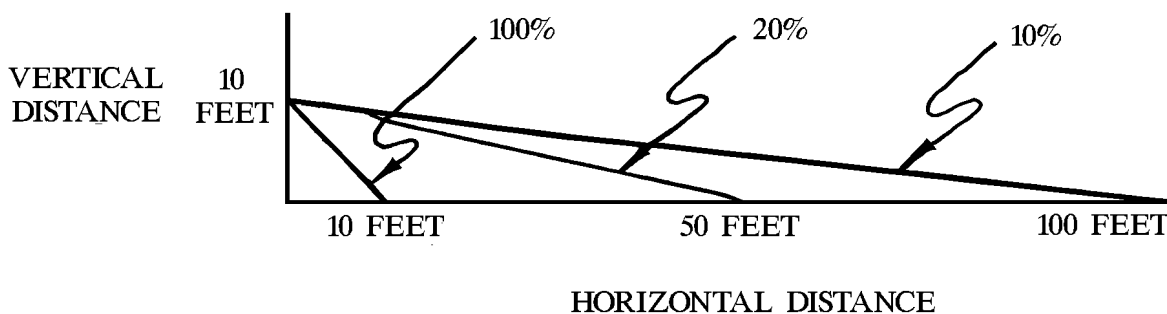
Facultative Wetland Species: Trees and shrubs that usually occur in wetlands (estimated probability 67-99%), but occasionally found in uplands (non-wetlands) (estimated probability 1-33%).

Forested Wetland - A wetland where trees are the dominant plants.

Freshwater Wetland - An area that is inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetland permits are required for any dredge, fill, or construction in a wetland, intermittent or perennial stream or other surface water.

Geotextile - A product used as a soil reinforcement agent and as a filter medium. It is made of synthetic fibers manufactured in a woven or loose non-woven manner to form a blanket like product.

Grade - Expressed in percent, the distance a road or trail rises or falls over a horizontal distance. For example, a road or trail that rises or falls 10 feet over 100 feet in horizontal distance has a 10% grade.



Intermittent Stream - A water course that flows in a well defined channel during the wet periods of the year or after major storms.

Marsh - A low-lying area with standing water or saturated soil for a sufficient portion of the year that is dominated by reeds, cattails, sedge, or grasslike vegetation.

Minimum Impact Forest Management Project - A temporary wetland crossing for forest management or timber harvesting purposes which is less than 50 feet in length and requires less than 3,000 square feet of fill, and which follows the Best Management Practices.

Mulch - A natural or artificial layer of plant residue or other materials covering the land surface that conserves moisture, holds soil in place, aids in establishing plant cover, and minimizes temperature fluctuations.

Obligate Upland Species: Trees and shrubs that almost always occur in uplands (non-wetlands) (estimated probability >99%).

Obligate Wetland Species: Trees and shrubs that almost always occur in wetlands (estimated probability >99%).

Perennial Stream - A watercourse that flows throughout the year or nearly so (90 percent) in a well defined channel. Same as a live stream.

Riprap - Rock or other large aggregate that is placed to protect streambanks, bridge abutments, outflow of drainage structures, or other erodible sites from runoff.

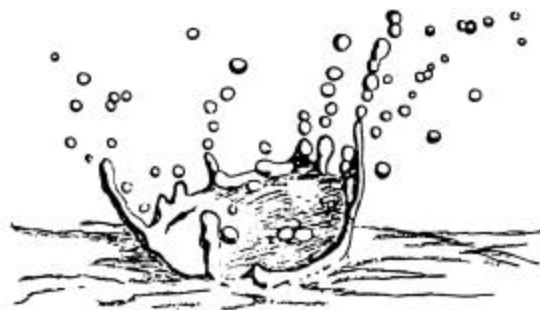
Sediment - Soil material that has been detached, transported, suspended, or settled in water.

Slope - Degree of deviation of a surface from the horizontal, measured as a numerical ratio, as a percent, or in degrees. Expressed as a ratio, the first number is the horizontal distance (run) and the second number is the vertical distance (rise), as 2:1. A 2:1 slope is a 50% slope. Expressed in degrees, the slope is the angle from the horizontal plane, with a 90 degree slope being vertical (maximum) and a 45 degree slope being a 1:1 slope.

Stream - Any channel for the passage of surface water having a defined bed and banks whether natural or artificial, with perennial or intermittent flow.

Swamp - A tree or shrub wetland, with standing water or saturated soils for a sufficient portion of the year, that often has a "hummocky" appearance and buttressed roots. Dominant full sized trees may include red maple, black ash, black willow, black spruce, tamarack, or white cedar.

Wetland - An area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic (water loving) vegetation and which has soils indicative of wet conditions.



PLANNING THE OPERATION

When the forest floor is disturbed and truck haul roads and skid trails are constructed, the natural filtering action of the soil is reduced. Trucks and skidders may compact the underlying soil. When it rains or the snow melts, surface water is not readily absorbed. Instead, the surface water flows into the roads and trails which can act as channels that increase the velocity and volume of the water as it flows downhill. As the water flows it may erode the soil and destroy the road and other capital improvements.

Water quality management through systematic planning helps prevent erosion. This kind of management can be achieved by planning and laying out the roads and skid trails correctly, and by finding ways to get the water off the roads and trails as quickly as possible, before erosion can accelerate. Careless construction leads to rebuilding, lost time, higher costs and harm to soil, water, and fish habitat.

If systematic planning does not take place before the operation begins, then there is the risk that the ditches, the crossdrains, culverts and water bars may not provide adequate drainage.

Guidelines:

Layout

- Obtain topographic maps, soils maps, aerial photographs and property maps.
- Use topographic maps, soils maps, and aerial photos to identify streams, forested wetlands, other bodies of water, steep slopes, flood plains, property boundaries, and harvest area boundaries.
- Locate the property lines and the area to be harvested on each of the maps and photographs.
- Walk the area and see how the land lays and where the stands for harvesting are located.
- Outline areas on the maps that are near streams, ponds, lakes, or wetlands, and mark very steep and very wet areas, and areas with poor timber.
- Consider the following for maximum erosion control:
 - ◆ Minimize the amount of soil disturbance
 - ◆ Minimize the amount of cut and fills
 - ◆ Minimize the number of stream crossings
 - ◆ Provide adequate drainage of the road and main skid trail area
 - ◆ Plan buffers around sensitive areas



- Draw on the maps the proposed location of your haul roads, main skid trails, and log landings. Look for the best placement on slopes, the position of streams and wetlands, possible stream crossings, and areas of soil instability.
- Walk the proposed location of haul roads and main skid trails. Establish control points along the way. These should be points you can identify on a map, aerial photograph, and on the ground.
- Flag this route as you walk in. Check skidding distances on both sides of your proposed route.
- Walk back out following your flagged route.
 1. Adjust flagging to take advantage of natural features that will make road and trail construction and drainage easier.
 2. Check the grades to make sure that they meet guidelines for truck haul roads and skid trails.
 3. Flag areas suitable for landings and borrow pits.
 4. Make sure the route provides the best access to present and future harvest areas.
- Draw on your maps the final proposed location of your truck haul roads, skid trails, stream crossings, erosion control devices, etc.
- Be aware of applicable state and local laws which relate to timber harvesting, wetlands, surface waters and fish and wildlife habitat. Obtain all necessary permits prior to any construction or timber harvesting. (See Logging and the Law)



Construction

During the construction of truck haul roads and skid trails, there are certain activities that must be planned because they directly relate to the amount of erosion that can occur.

- **Timing** - Most problems can be prevented or minimized by timing the harvesting operation to take advantage of seasonal conditions.
 1. Winter harvesting to take advantage of snow cover and frozen ground.
 2. Bridge construction and culvert installation should be done during summer when stream flow is low.

3. On streams having important fisheries value, bridge and culvert installation should be avoided during egg incubation period of October to April.
 4. If construction is necessary, it should be done well ahead of time to permit disturbed soil to stabilize before the road or trail is to be used.
- **Design** - The entire road and trail system should be designed before any construction begins. This process may seem to take more time, but the system will be more efficient, less costly, and easier to maintain.
 1. **Grade** - Keep grades low except where short, steep sections are needed to take advantage of favorable topography and to avoid excessive cut and fill.
 2. **Width** - The width of the road or trail should be designed for the equipment to be used on the timber harvesting operation.
 3. **Angle** - Consider the proper angle for cuts and fills in designing roads on varying types of soils and rock materials. Make road cuts reasonably steep in order to minimize surface exposed to erosion.
 4. **Alignment** - Avoid the toes of slopes, breaks in a slope, and running parallel to a streambank.
 5. **Surface** - Crushed rock and gravel may be needed to keep the road surface from washing out during rainfall and runoff.
 6. **Drainage** - Provisions must be made for the passage of surface water from adjacent slopes, as well as for rapid drainage of the roadbed itself.
 7. **Stream Crossings** - All crossings sites should be selected at right angles to the stream and should not interfere with natural streamflow.

Retirement

A plan should be developed that provides for the retirement of truck haul roads, skid trails, and log landings.

- Smooth and shape all road and landing surfaces.
- Remove all temporary culverts and replace them with water bars, broad based dips, or ditches.
- Permanent culverts must be sized properly and provisions made for their continued maintenance.
- Remove all temporary stream and wetland crossings.
- Seed, mulch, lime, and fertilize

ARE YOU IN A WETLAND?

Wetlands Characteristics:

Hydrology, or the presence of water in or above the soil;

Signs on the surface of the ground include:

- Waterstained (dark) or silt covered leaves;
- Lines of organic debris such as leaf litter on tree and shrub stems above soil surface;
- Water or silt stained plant stems;
- Swollen bases of tree trunks (an adaptation to wet soils);
- Exposed plant roots (an adaptation to wet soils).

Soils, which show observable features when saturated or flooded for long periods of time;

Signs in the soil include:

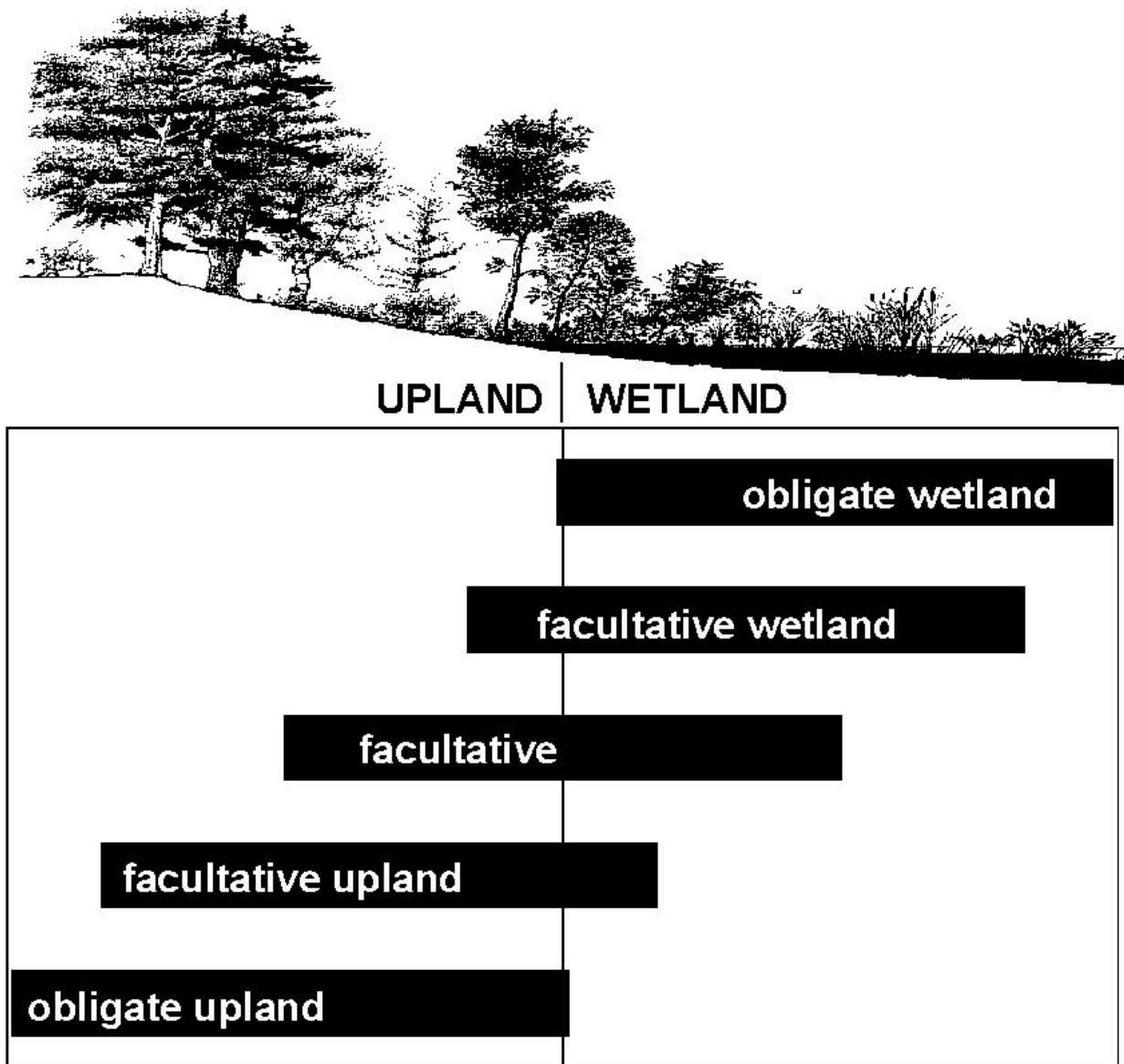
- Sphagnum moss on the surface;
- A thick upper layer of peaty organic matter;
- Soils mostly neutral grey in color (gleyed), or grey soils with rust colored (orange-brown and yellow-brown) splotches within 18" of the surface.

Vegetation, which is usually composed of a predominance of species suited to hydric (largely anerobic) soil habitats.

Signs in the composition of plant species include:

- More than half the plant species being those that grow most often in wetland soils. Plant species have been classified by the US Fish & Wildlife Service based on how frequently they occur in wetlands. All plants, including herbaceous groundcovers, are important in wetland determination. However, only trees and shrubs are included here because there are fewer species than herbaceous plants, they are more easily identified by most people and they can be observed and identified at all times of the year. The species are grouped into five categories, listed here from most to least wetland adapted:

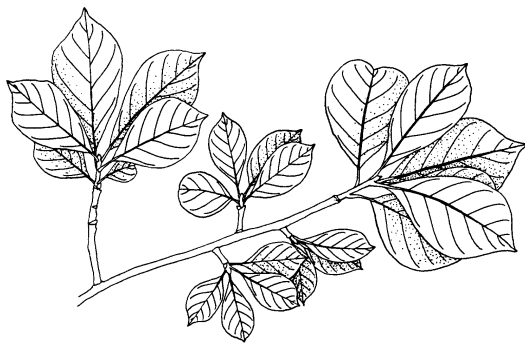
Obligate Wetland.....Species occur more than 99% of the time in wetlands.
 Facultative Wetland.....Species occur between 67-99% of the time in wetlands.
 Facultative.....Species occur equally in uplands and wetlands.
 Facultative Upland.....Species occur between 1-33% of the time in wetlands.
 Obligate Upland.....Species occur less than 99% of the time in wetlands.



Care must be taken when estimating wetland conditions using only plants. One reason is that common trees in the most marginal (least wet) wetlands (forested wetlands) are often the facultative species Red maple and Balsam fir and the facultative upland species Eastern hemlock. Even White pine and other species more commonly found in drier sites will grow on raised hummocks in a forested wetland. In these cases, a survey of the shrubs present will often provide a better indication of wetland conditions, as will groundcovers if they are present. In many forested wetlands, Highbush blueberry and Winterberry holly are common and readily identified at any time of the year.

The technical determination of wetland boundaries incorporates all these characteristics, but is not practical for informal determination of whether you are working in a wetland. However, a rough estimate of a wetland boundary can be made using the signs given above. Begin by finding an area that seems obviously to be a wetland. Then, walk toward the upland, noting changes in vegetation as you go. If possible, sample the soil for the characteristics and look for above-ground signs noted above. When you no longer observe a majority of wetland plants or soil conditions, consider this the approximate wetland edge. This process can be repeated at intervals around the wetland edge, marking as you go.

If you're not sure about wetland determination, refer to section in this manual on Available Assistance.



FREQUENCY OF OCCURRENCE OF SELECTED NEW HAMPSHIRE *SHRUB SPECIES* IN WETLANDS AND UPLANDS

OBLIGATE WETLAND SPECIES

(>99% in wetlands, <1% in uplands)

Buttonbush	<i>Cephalanthus occidentalis</i>
Cranberry, Large	<i>Vaccinium macrocarpon</i>
Cranberry, Small	<i>Vaccinium oxycoccos</i>
Labrador Tea	<i>Ledum groenlandicum</i>
Leatherleaf	<i>Chamaedaphne calyculata</i>
Mountain Holly	<i>Nemopanthus mucronatus</i>
Rose, Swamp	<i>Rosa palustris</i>
Rosemary, Bog	<i>Andromeda polifolia</i>
Sumac, Poison	<i>Toxicodendron vernix</i>
Sweetgale	<i>Myrica gale</i>

FACULTATIVE WETLAND SPECIES

(67 - 99% in wetlands, 1 - 33% in uplands)

Alder, Speckled	<i>Alnus rugosa</i>
Arrow-Wood	<i>Viburnum recognitum</i>
Azalea, Swamp	<i>Rhododendron viscosum</i>
Blueberry, Highbush	<i>Vaccinium corymbosum</i>
Chokeberry, Red	<i>Aronia arbutifolia</i>
Dogwood, Red Osier	<i>Cornus stolonifera</i>
Dogwood, Silky	<i>Cornus amomum</i>
Elder, American	<i>Sambucus canadensis</i>
Maleberry	<i>Lyonia ligustrina</i>
Rhodora	<i>Rhododendron canadense</i>
Spicebush	<i>Lindera benzoin</i>
Steeple-Bush	<i>Spiraea tomentosa</i>
Winterberry Holly	<i>Ilex verticillata</i>
Withe-Rod	<i>Viburnum cassinoides</i>

FACULTATIVE SPECIES

(Likely to occur equally (34 - 66%) in uplands and wetlands.)

Bayberry	<i>Myrica pensylvanica</i>
Chokeberry, Black	<i>Aronia melanocarpa</i>
Cranberry, Mountain	<i>Vaccinium vitis-idaea</i>
Ivy, Poison	<i>Toxicodendron radicans</i>
Meadow-Sweet	<i>Spiraea latifolia</i>
Nannyberry	<i>Viburnum lentago</i>

Pepper-Bush
 Raspberry, Red
 Rhododendron, Rosebay
 Rose, Virginia
 Sheep-Laurel
 Yew, American

Clethra alnifolia
Rubus idaeus
Rhododendron maximum
Rosa virginiana
Kalmia angustifolia
Taxus canadensis

FACULTATIVE UPLAND SPECIES (1 - 33% in wetlands, 67 - 99% in uplands)

Barberry, European
 Barberry, Japanese
 Bitter-sweet, American
 Blackberry, Allegheny
 Blueberry, Lowbush
 Elder, Red
 Hazel-nut, Beaked
 Hobble-Bush
 Juniper, Creeping
 Laurel, Mountain
 Rose, Rugosa
 Teaberry (Checkerberry)
 Witch-Hazel

Berberis vulgaris
Berberis thunbergii
Celastrus scandens
Rubus alleghaniensis
Vaccinium angustifolium
Sambucus racemosa
Corylus cornuta
Viburnum lantanoides
Juniperus horizontalis
Kalmia latifolia
Rosa rugosa
Gaultheria procumbens
Hamamelis virginiana

OBLIGATE UPLAND SPECIES

(< 1% in wetlands, >99% in uplands)

Juniper, Common
 Sumac, Smooth
 Sumac, Staghorn
 Sweet Fern
 Viburnum, Maple-leaved

Juniperus communis
Rhus glabra
Rhus typhina
Comptonia peregrina
Viburnum acerifolium



FREQUENCY OF OCCURRENCE OF SELECTED NEW HAMPSHIRE *TREE SPECIES* IN WETLANDS AND UPLANDS

OBLIGATE WETLAND SPECIES

(>99% in wetlands, <1% in uplands)

Atlantic White Cedar

Chamaecyparis thyoides

FACULTATIVE WETLAND SPECIES

(67 - 99% in wetlands, 1 - 33% in uplands)

Black Ash

Fraxinus nigra

Green Ash

Fraxinus pensylvanica

River Birch

Betula nigra

Northern White Cedar

Thuja occidentalis

American Elm

Ulmus americana

American Larch

Larix laricina

Silver Maple

Acer saccharinum

Swamp White Oak

Quercus alba

Balsam Poplar

Populus balsamifera

Black Spruce

Picea mariana

Sycamore

Platanus occidentalis

Tupelo (Black Gum)

Nyssa sylvatica

Black Willow

Salix nigra

FACULTATIVE SPECIES

(Likely to occur equally (34-66%) in uplands and wetlands.)

Gray Birch

Betula populifolia

Yellow Birch

Betula alleghaniensis

Cottonwood

Populus deltoides

Slippery Elm

Ulmus rubra

Balsam Fir

Abies balsamea

Honey Locust

Gleditsia triacanthos

Ironwood

Carpinus caroliniana

Red Maple

Acer rubrum

FACULTATIVE UPLAND SPECIES

(1 - 33% in wetlands, 67 - 99% in uplands)

White Ash

Fraxinus americana

Big-tooth Aspen

Populus grandidentata

Quaking Aspen

Populus tremuloides

Basswood

Tilia americana

American Beech

Fagus grandifolia

Paper Birch

Betula papyrifera

Sweet Birch

Betula lenta

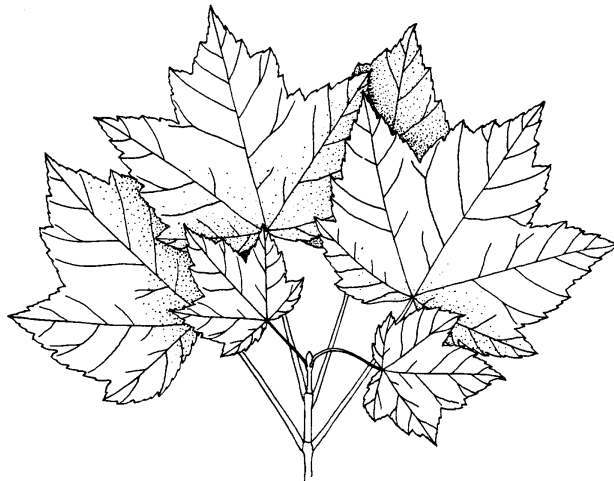
Butternut
 Red Cedar
 Black Cherry
 Choke Cherry
 Fire Cherry
 Flowering Dogwood
 Eastern Hemlock
 Shagbark Hickory
 Hop Hornbeam
 Black Locust
 Striped Maple
 Sugar Maple
 Red Oak
 White Oak
 White Pine
 Pitch Pine
 Red Pine
 Sassafras
 Red Spruce
 White Spruce
 Black Walnut

Juglans cinerea
Juniperus virginiana
Prunus serotina
Prunus virginiana
Prunus pensylvanica
Cornus florida
Tsuga canadensis
Carya ovata
Ostrya virginiana
Robinia pseudoacacia
Acer pensylvanicum
Acer saccharum
Quercus rubra
Quercus alba
Pinus strobus
Pinus rigida
Pinus resinosa
Sassafras albidum
Picea rubens
Picea glauca
Juglans nigra

OBLIGATE UPLAND SPECIES

(< 1% in wetlands, >99% in uplands)

None



TRUCK HAUL ROADS

☐ **Definition:**

A road system, temporary or permanent, installed for transportation of wood products from the landing by truck.

☐ **Purpose:**

To provide for an efficient transportation system for forest products from the landing while also protecting forest land and water quality, for recreation, forest fire access, or other needed forest management activities.

☐ **Condition Where Practices Applies:**

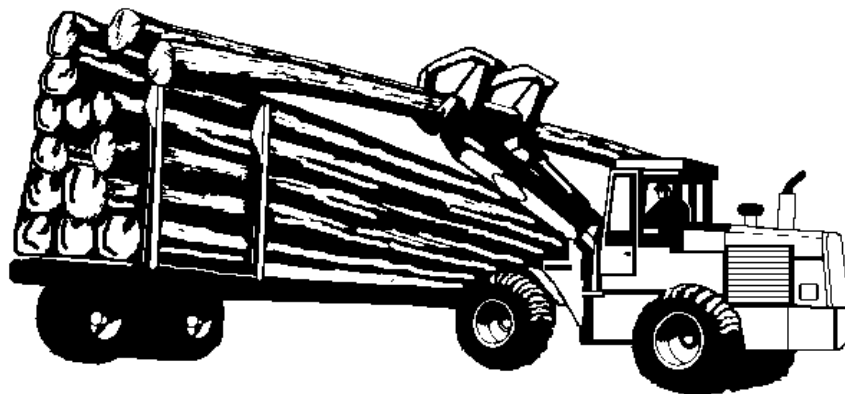
Where area and volume to be harvested makes it necessary and economically feasible to install such a road system.

Guidelines:

- A well thought out efficient transportation system will minimize the area disturbed and vulnerable to erosion.
- Keep the length of the truck road, from the log landing to a public highway, to a minimum. Have gravel or wood chips for about 200 feet prior to entering on a public highway to keep mud off of the highway.



- Road grades should be kept to 10% or less. Steeper grades are permissible for short distances. Long level sections are difficult to drain properly. Grades between 3% and 5% are desirable.
- Place roads on high ground with gentle grades. Avoid sharp curves. Use a fifty foot minimum radius for large trucks.
- Minimum tread width is 10 feet for one-way traffic and 15 feet for two-way traffic. Increase the tread width by a minimum of 4 feet for trailer traffic.
- Use a geotextile construction fabric underlayment when constructing roads on poorly drained surface.
- Move surface water quickly off road surfaces and onto undisturbed forest floor. Ditches should be used to efficiently divert water away from the road surface. Water entering a roadway should be moved under or away from the roadway before gaining sufficient flow and velocity to erode ditches. Drainage ditches should not end where they will feed water directly into streams or other surface waters. (See Erosion Control Devices)
- If streams must be crossed, do so by the most direct route and preferably at right angles to the stream. A bridge, culvert, or food of acceptable design may be required. (See Stream Crossings)
- Road grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the watercourse. (See Erosion Control Devices)
- Restrict vehicle traffic on soft roads during Spring and Fall mud seasons.
- Restrict vehicle traffic during heavy rains.
- Do not allow skidding on truck roads.
- Check with the State of New Hampshire - Department of Transportation or the local town officials to determine if a driveway permit is required.



SKID TRAILS

❑ Definition:

An un-surfaced, single lane trail system usually steeper and narrower than a truck road and used for skidding harvested products.

❑ Purpose:

To bring logs, tree lengths, or other round wood products from the stump to a log landing or concentration area.

❑ Conditions Where Practice Applies:

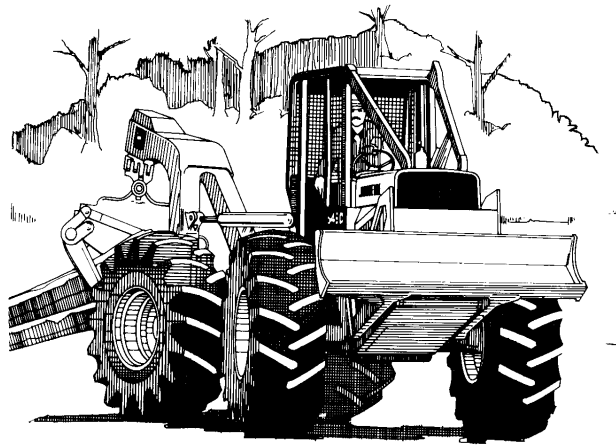
Use where harvested products must be brought to one location for sawing, chipping or loading. Where topography and size of operation make this the most economical means of collecting logs, trees, or other round wood products.

Guidelines:

- A well thought out efficient transportation system will minimize the area disturbed and vulnerable to erosion.
- Trail grades should be kept to 15% or less. Steeper grades are permissible for shorter distances.
- Plan skid trails from the top down.



- Locate skid trails to take advantage of natural cross drainage.
- Use reverse grades and provide upgrade turns where natural reverse grades are not available. (See Erosion Control Devices - Reverse Grades)
- Major skid trails should be located away from streams, ponds, lakes, and wetlands. (See Erosion Control Devices - Streamside Management Zone)
- Move surface water quickly off trail surfaces and on to undisturbed forest floor. (See Erosion Control Devices)
- If streams must be crossed, do so by the most direct route and preferable at right angles to the stream. A bridge, culvert, or ford of acceptable design may be required. (See - Stream Crossings)



- Trail grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the water course. (See Erosion Control Devices)
- **At no time will logs be permitted to be skidded or equipment driven through flowing streams.**
- Skid across slope where feasible.
- Skid uphill to the log landing whenever possible so that water running in the skid trails is dispersed away from landing.
- Silt fencing, haybale erosion checks or water diversions shall be used to prevent soil from skid trails from entering streams and other surface waters.
- Use brush to minimize rutting in soft soil.

LOG LANDINGS

❑ Definition:

An area where harvested logs and trees are temporarily stored and assembled.

❑ Purpose:

To provide an area where forest products are sorted and loaded onto trucks for transport to a mill.

❑ Conditions Where Practice Applies:

Should be so located as to minimize the adverse impact of skidding operations in sensitive areas and on the natural drainage pattern

Guidelines:

- Landings should not be located in streamside management zone.
- Set landings back 100 feet or more from streams, ponds, lakes, and wetlands.
- If landings cannot be set back 100 feet from streams, pond, lakes, and wetlands, sediment traps should be used to minimize sedimentation from surface runoff. Adequate streamside management zone should be left between landings and water courses.
- Locate landings away from low or poorly drained areas.
- Locate landings on gently sloping ground that allows for good drainage.
- Landings should be sized to the minimum required for the area to be cut, the equipment used and the diversity of products produced.
- Construct diversion ditch around uphill side of landings where seepage and lateral flow of water may be a problem.
- Provide adequate drainage on approach trails so that drainage does not enter landing area.
- Divert water draining from landings so that it does not enter truck roads, skid trails, or flow directly into streams, ponds, lakes, or wetlands.
- Servicing of equipment on site must be done in such a way that old oil, hydraulic fluid, etc., should be properly contained and removed from the site and disposed of in accordance with proper waste disposal procedures.

STREAMSIDE MANAGEMENT ZONE

☐ **Definition:**

A protective strip of undisturbed forest soil between disturbed areas (skid trails, truck roads, and log landings) and a water course (stream, pond, lake, and wetlands).

☐ **Purpose:**

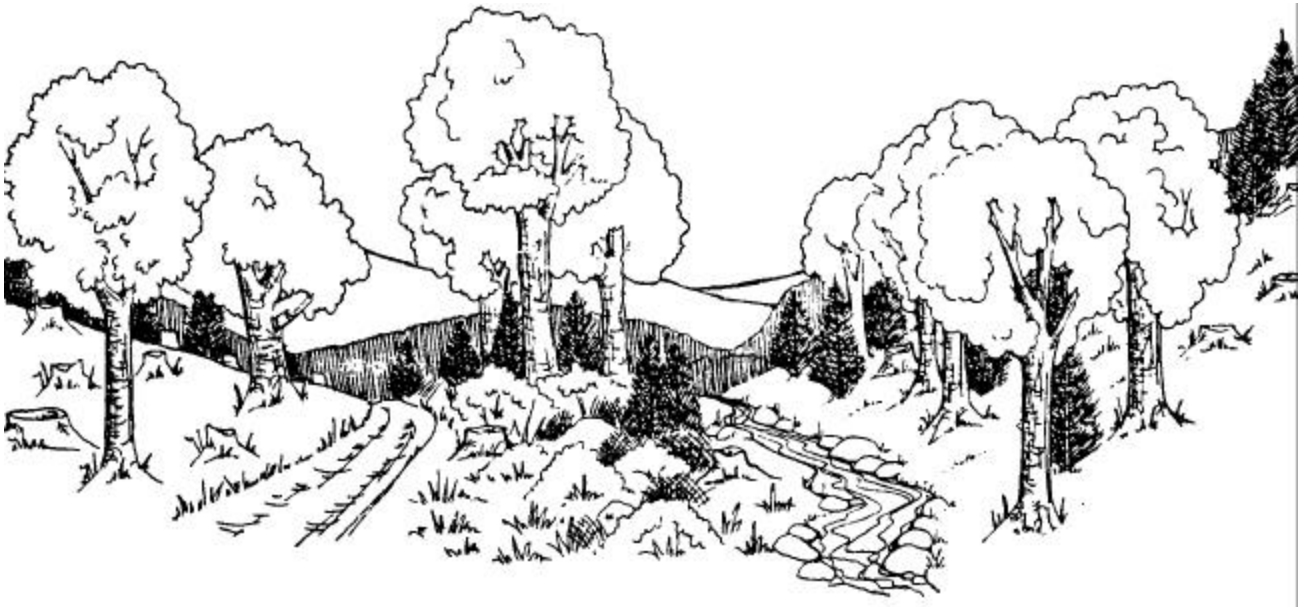
To provide an undisturbed zone to slow runoff, allowing sediment to settle and be filtered out before reaching a water course.

☐ **Conditions Where Practice Applies:**

Should be maintained between all water courses and truck roads, major skid trails, or log landings where soil has been exposed.

Guidelines:

- The streamside management zone should be protected to prevent exposure of mineral soil. Equipment operation in this area should be limited. If mineral soil is exposed, it should be stabilized by seeding and/or mulching as soon as possible.
- Harvesting practices which do not expose mineral soil may take place in the streamside management zone such as felling and winching of timber.



- No log landings should be within the streamside management zone.
- Truck roads and major skid trails should not be within the streamside management zone except when entering and leaving stream crossings.
- New Hampshire law limits harvesting near surface waters and public roads.

STREAMSIDE MANAGEMENT ZONE WIDTHS

Side slope (percent)	Width (feet)
0 - 10	50
11 - 20	70
21 - 30	90
31 - 40	110

Note: Add 20 feet for each additional 10 percent of side slope.

BROAD BASED DIPS

□ Definition:

A dip and reverse slope in a truck road surface with an outslope in the dip for natural cross drainage.

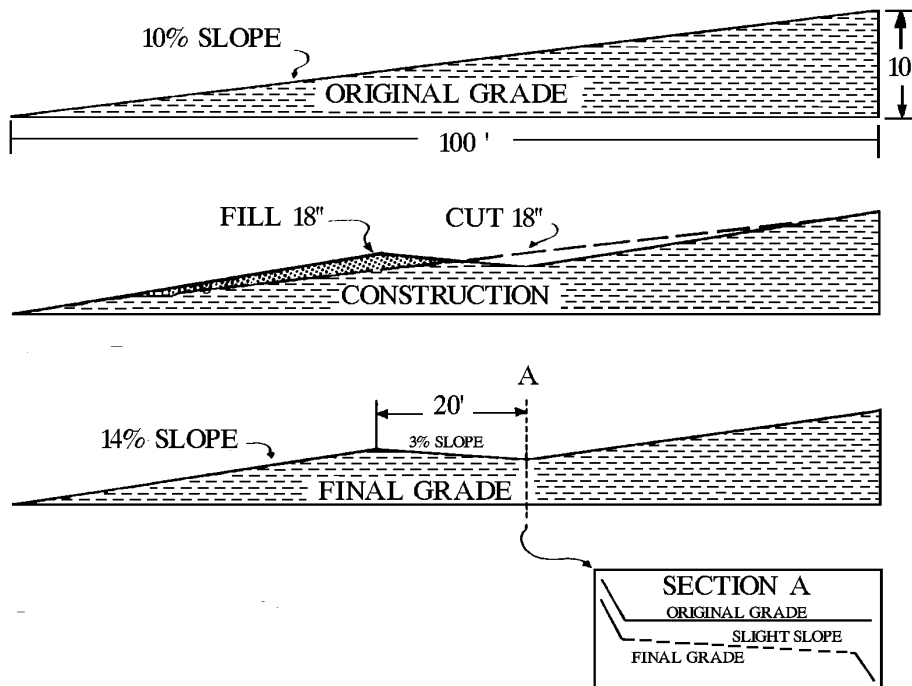
□ Purpose:

To provide cross drainage on insloped truck roads to prevent build-up of excessive surface runoff and subsequent erosion.

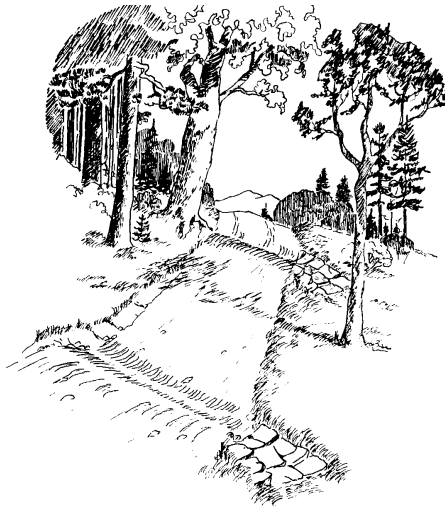
❑ Conditions Where Practice Applies:

Use on truck roads and heavily used skid trails having a gradient of 10% or less. May be substituted for other cross drainage structures where no intermittent or permanent streams are present.

Guidelines:



- Proper construction requires an experienced bulldozer operator.
- Installed after the basic roadbed has been constructed and before major hauling use.
- On grades steeper than 8%, surface dips with stone (approx. 3" diameter) or gravel.
- Use dips on approaches to steep declines in heavily used skid trails.
- Discharge area should be protected with stone, grass sod, heavy litter cover or slash and logs to reduce the velocity and filter the water.



SPACING FOR BROAD BASED DIPS

Road Grade (percent)	Spacing Between Dips (feet)
2	300
4	200
6	165
8	150
10	140
12	130

WATER BARS

☐ Definition:

An excavated channel with earthen or reinforced berm constructed across a truck road or skid trail.

☐ Purpose:

To intercept and divert water from side ditches and truck road or skid trail surfaces, minimizing erosion by decreasing the slope length of surface water flow.

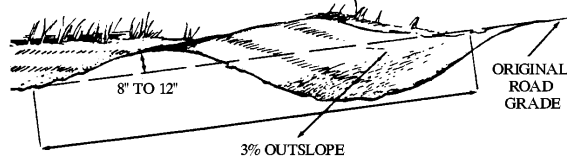
☐ Conditions Where Practice Applies:

On any sloping truck road or skid trail where surface water runoff may cause erosion.

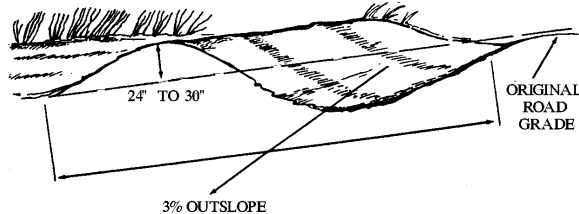
Guidelines:

- Start placement of water bars at the farthest skid trail and work back to the log landing and then to the truck road.
- Install water bars with a skidder blade, dozer blade, excavator or by hand.

SHALLOW WATER BAR



DEEP WATER BAR



- Install water bars at the top of any sloping road or trail and at proper spacing along steep sections.
- Water bars may be shallow or deep depending on the need.
- Soil should be left along the lower side of the water bar.
- Should be constructed at a 30° - 35° angle downslope from a line perpendicular to the direction of the truck road or skid trail.
- Should drain at a 3% outslope onto undisturbed litter or vegetation.
- The uphill end of the water bar should extend beyond the side ditch line of the road or trail to fully intercept any water flow.
- The downhill end of the water bar should be fully open and extended far enough beyond the edge of the road or trail to disperse runoff water onto undisturbed forest floor.
- Place rocks, slash, or logs to disperse water coming from a water bar.
- If the road or trail is to be kept open after the harvesting operation, the following guidelines should be used in order to preserve effective water bars.

-Reinforce the water bars

-Keep travel to a minimum

-Use only in dry weather

-Make frequent inspections

-Maintain as needed

SPACING FOR WATER BARS

Road/Trail Grade (percent)	Spacing Between Water Bars (feet)
2	250
5	135
10	80
15	60
20	45
30	35

REVERSE GRADES

☐ **Definition:**

A short rise in a downhill skid trail that forces any water in the trail to drain off to the side. Obtained by turning the skid trail up the hill a short distance then turning downhill again.

☐ **Purpose:**

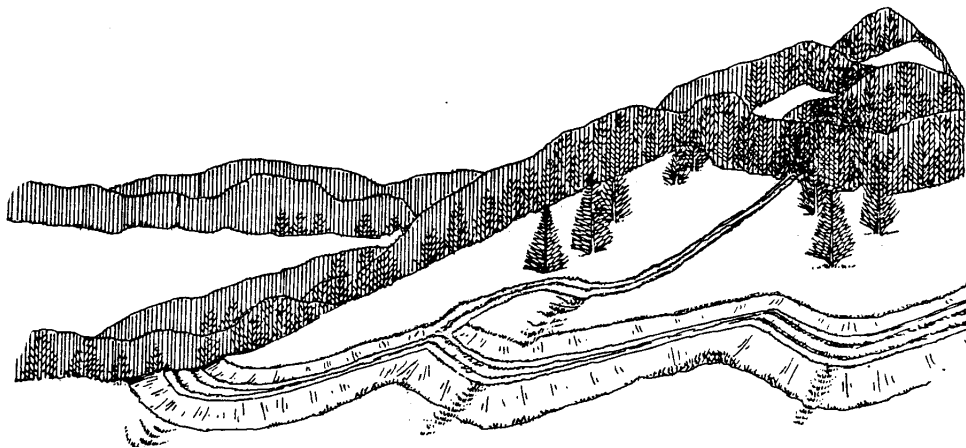
To break the grade of the skid trail as often as practical, therefore limiting slope length.

☐ **Condition Where Practice Applies:**

Where additional drainage can be provided by taking advantage of natural cross drainage on sidehill locations.

Guidelines:

- Reverse grades are commonly applied to only skid trails.
- Requires greater planning and layout of trail system.
- Use in conjunction with other water control measures.
- Requires minimum construction time and low maintenance.
- Unsuitable on very steep terrain and hardpan soils.



CROSS DRAINAGE CULVERTS

☐ **Definition:**

Corrugated pipe, well casing, dredge pipe, or other suitable material placed under a truck haul road or major skid road to transmit ditch runoff and seeps from a drainage area of less than 10 acres.

☐ **Purpose:**

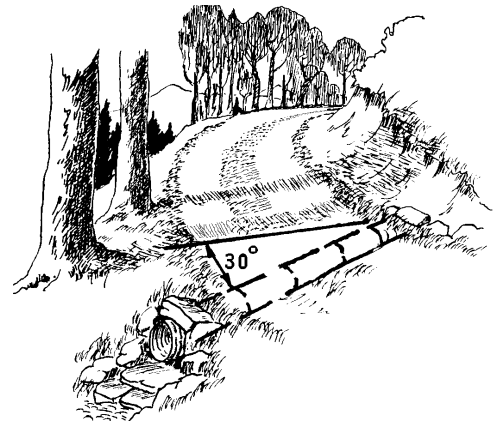
To collect and transmit water flows from side ditches and seeps, under truck haul roads and major skid trails safely without eroding a drainage system or road surface.

☐ **Conditions Where Practice Applies:**

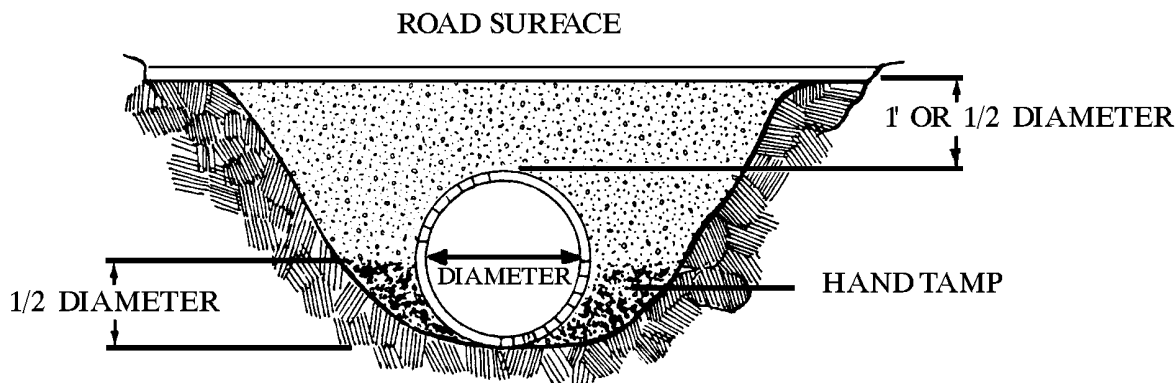
For any size operation where cross drainage of storm water is required temporarily or permanently.

Guidelines:

- This is the most expensive method of road cross drainage and should be used where heavy use is anticipated during and after the harvesting operation.
- When sizing culverts for temporary roads, allow for periods of high flow, such as spring runoff or cloudbursts.
- The minimum size culvert to be installed is 12 inch diameter and 20 feet in length.
- When constructing roads on sidehill locations, ditch the uphill side of the roadway to intercept surface runoff.
- Allow inlet end of culvert to extend into side ditch so that it intercepts water flowing in the ditch. Construct a berm across the side ditch to assist in diverting water into the culvert.
- Allow outlet end of culvert to extend beyond any fill and empty onto an apron of rock, gravel or logs.



- Space culverts according to road grade:
 On gentle slopes (1-2%).....300 feet
 On moderate slopes (3-10%).....150 feet
 On steep slopes (10%+).....100 feet or less
- Culverts should be installed at a 30-35 degree angle downgrade.
- Culverts should be sloped at least 5 inches for every 10 feet of length to permit self-cleaning.
- When harvesting operation has been completed, the road should be stabilized by installing water bars and removing all pipe culverts from truck roads which will not be maintained.
- Culverts, when not maintained, are very likely to become blocked with rocks, ice or other debris. Runoff water can become rerouted over and around the culvert and may wash out sections of road into brooks, streams, ponds or wetlands. It is important to clean culverts regularly. Check after every storm.
- Culvert size selection should be based on the size of the drainage area of the watershed and should be able to handle the largest flows.
- Estimate drainage area by taking measurements on a USGS topographic map, using contour lines to define the drainage limits. The Natural Resource Conservation Service can assist you with determination of drainage area.



OPEN TOP CULVERTS

☐ Definition:

A wooden, concrete, or slotted steel pipe culvert placed across truck haul roads to convey surface runoff and side ditch flows across to down slope side.

☐ Purpose:

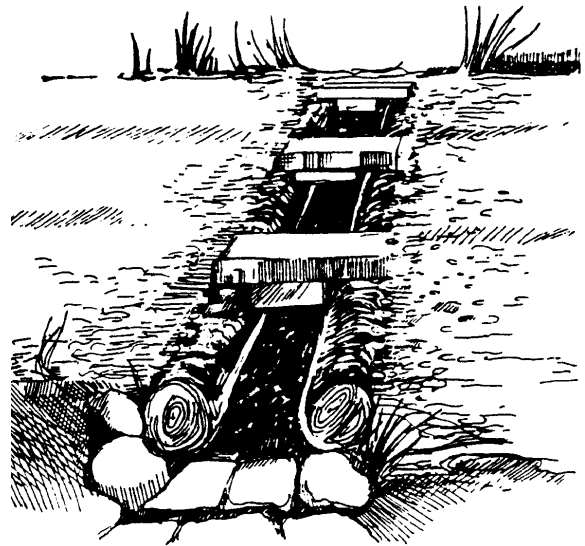
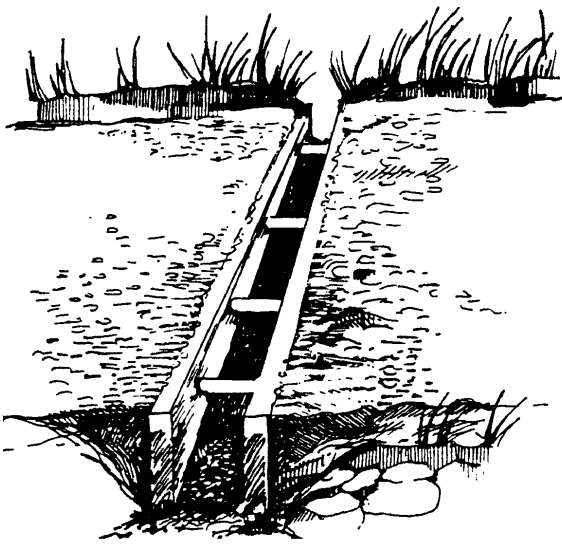
To collect and direct road surface storm runoff and upslope side ditch flows across road without eroding drainage system or road surfaces.

☐ Conditions Where Practice Applies:

This practice is a temporary or permanent drainage structure for truck haul roads. Properly built and maintained, it can be used for cross drainage on roads of smaller operations as a substitute for a cross drainage culvert. This practice should not be used for handling intermittent or live streams or skid trail cross drainage.

Guidelines:

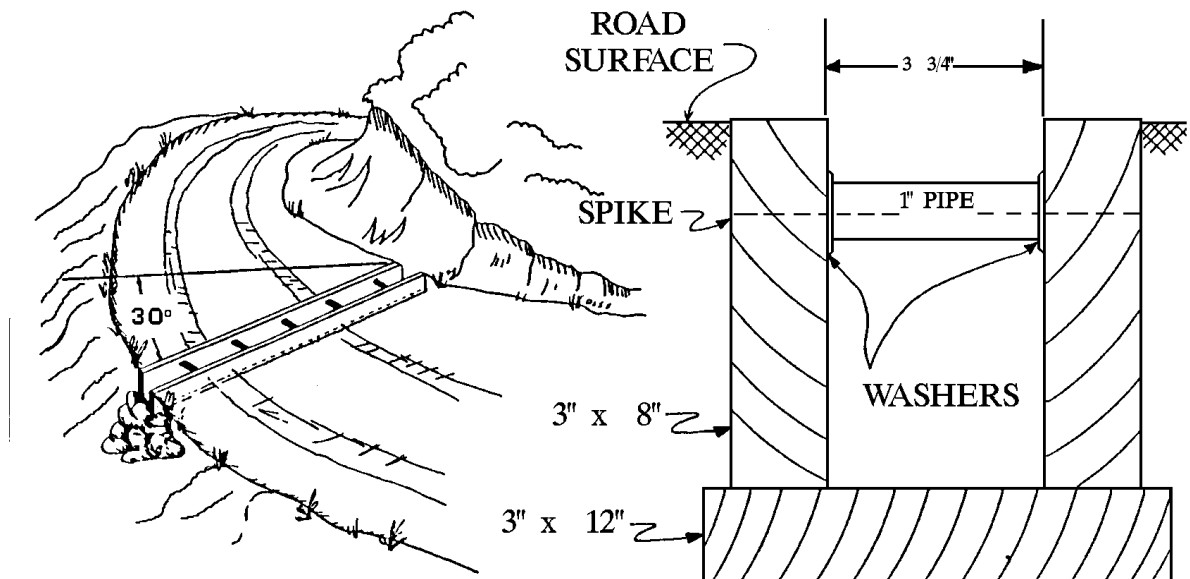
- Can be constructed of cull logs or from sawn lumber. If made of durable wood or treated material, these culverts will give many years of service.
- Install flush with the road surface and skewed at an angle not less than 30 degrees downgrade.



- Allow the inlet end to extend into the cut slope or side ditch so that it intercepts water.
- Allow outlet end to extend beyond any fill and empty onto an apron of rock, gravel or logs.
- Open top culverts must be cleaned regularly to remove sediments, gravel, and logging debris to allow normal function of structure at all times.

SPACING FOR OPEN TOP CULVERTS

Road Grade(percent)	Spacing Between Culverts(feet)
1 - 2%	300
3 - 10%	150
10%+	100 or less



INSLOPING

❑ Definition:

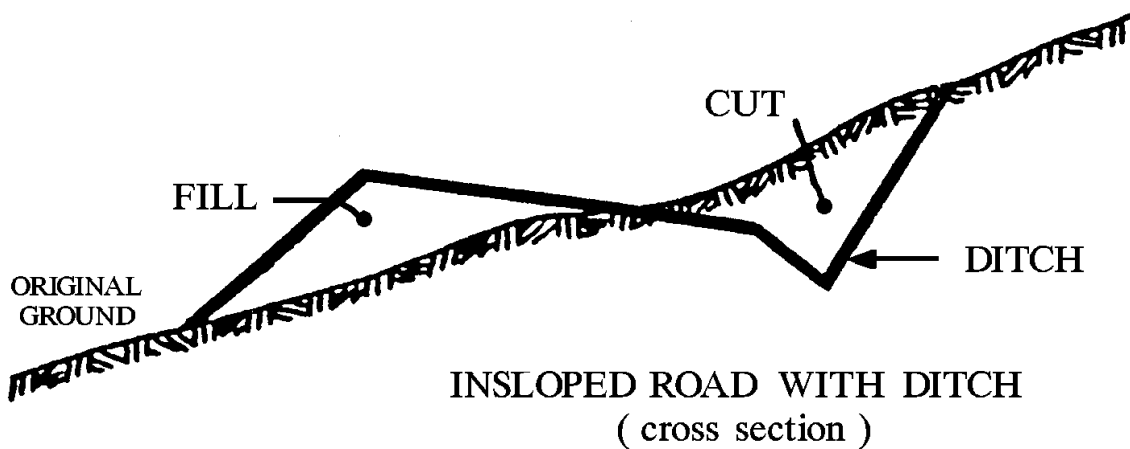
A section of road is sloped slightly (1-3%) toward the cut bank.

❑ Purpose:

Effective way of limiting erosion because water is removed from the road surface quickly and diverted directly to the inside ditch which will carry the water into a culvert.

❑ Condition Where Practice Applies:

Used when the soils are easily saturated or highly erodible. This will limit the amount of ditch water which will flow on to unstable fills.



OUTSLOPING

☐ **Definition:**

A section of road sloped slightly (1-3%) from the cut bank to the outside edge of the road bed.

☐ **Purpose:**

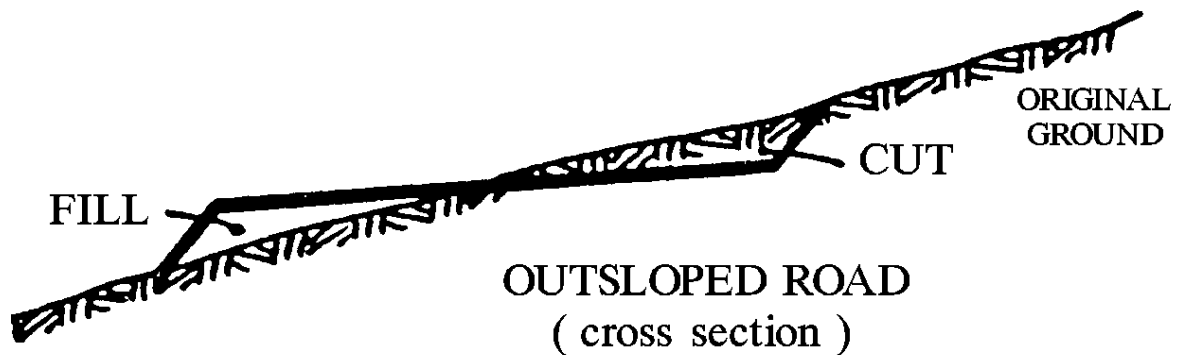
To prevent erosion by diverting runoff from a road surface on to undisturbed forest floor.

☐ **Condition Where Practice Applies:**

Used when the area is entirely rock, or when water can be diverted on to undisturbed forest floor.

Guidelines:

- Outsloping on fill is not desirable.
- For safety, do not use for trucking during freezing weather.
- Do not use on silty or hardpan soils when wet or if seeps are present.



CROWNING

❑ Definition:

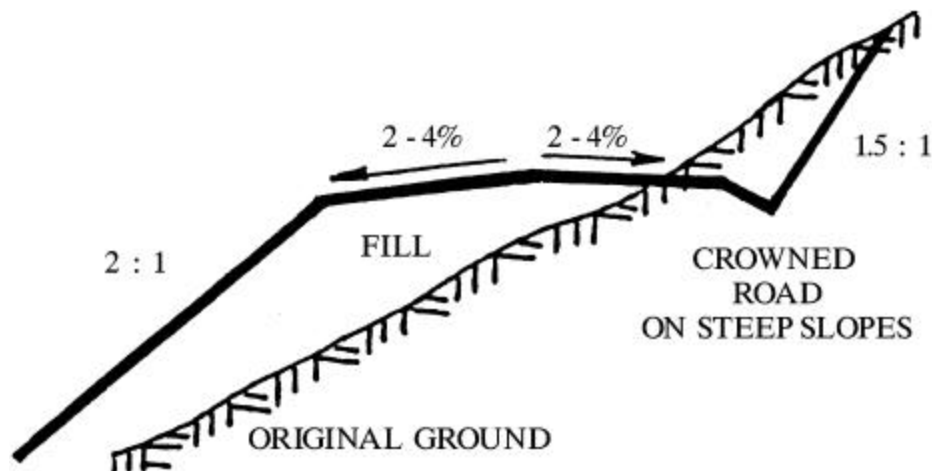
A section of road is sloped slightly (2-4%) from the centerline of the road to the outside edges of the roadbed.

❑ Purpose:

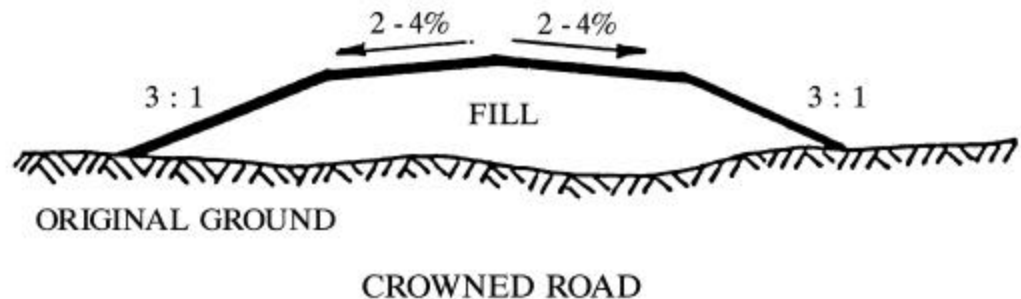
Effective way of limiting erosion because water is removed from the road surface quickly and diverted directly onto the forest floor or into a ditch that will carry the water into a culvert.

❑ Conditions Where Practice Applies:

Used when soils are easily saturated or highly erodible when adjacent areas are relatively level with roadbed or on steep side hills.



Guidelines:



CORDUROY

❑ Definition:

Crossing of a wet area where there is not a defined channel using poles or cull logs as a roadbed.

❑ Purpose:

To be used as a wet area crossing by a skid trail where it is necessary to provide soil stability.

❑ Conditions Where Practice Applies:

To be constructed on wet soils subject to rutting and extreme compaction by timber harvesting equipment

Guidelines:

- Use geo-textile fabric or other appropriate bedding.
- Place 8 - 10 inch diameter poles or cull logs side by side in wet area to serve as a roadbed.
- Place poles or cull logs perpendicular to the direction of travel across wet area.
- The top width of corduroy roadway should be at least 10 feet.
- Shall not be crossed when they are overtopped with water.
- After corduroy roadway has been overtopped with water, repair and maintenance will be required.
- Corduroy roadway should be inspected regularly.
- May be left in place after harvesting operation has been completed.

TEMPORARY BRIDGE

☐ **Definition:**

A structure of wood and steel materials installed across a natural or constructed channel or stream.

☐ **Purpose:**

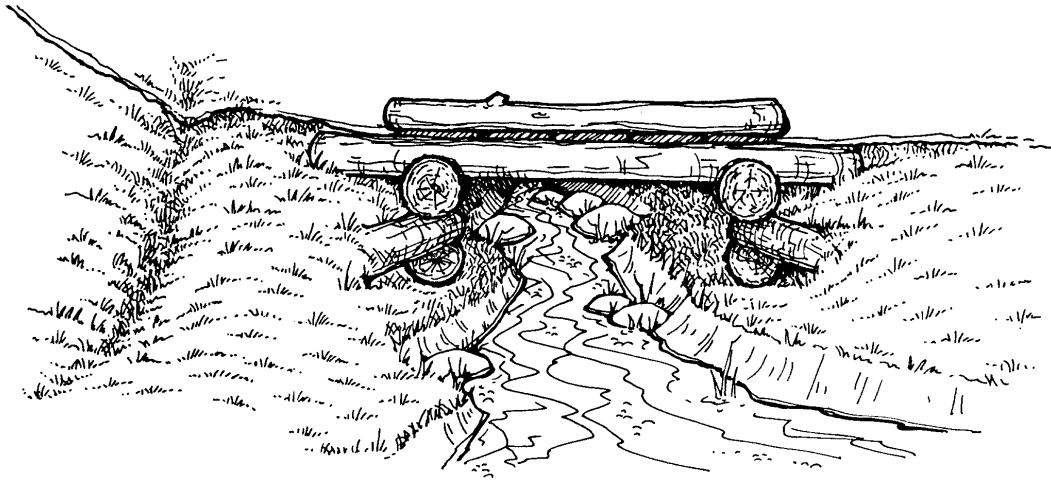
To carry a single lane haul road or skid trail over a stream to enable more direct routing while keeping equipment and products out of the water.

☐ **Conditions Where Practice Applies:**

Where restrictions such as topography or property lines make it necessary to cross a stream. Stream crossings are a major concern in the construction and use of a truck haul roads and skid trails because of the potential for large amounts of sediment to enter a stream. Keep the number of stream crossings to a minimum.

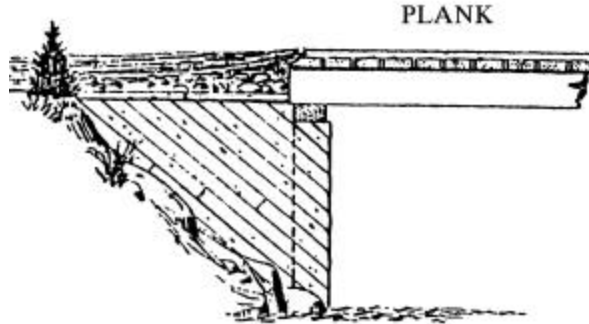
Guidelines:

- Install bridges at right angle to the stream. A maximum of 15 degree skew may be allowed as an exception where approach conditions are difficult.
- Align approach and exit with the bridge's center line with as little curvature as possible.
- Stream alignment should be straight at the point of crossing and of uniform profile.



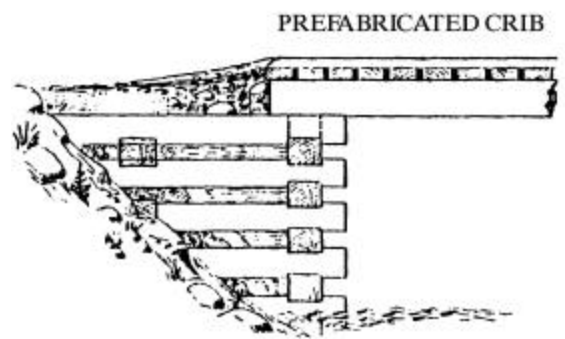
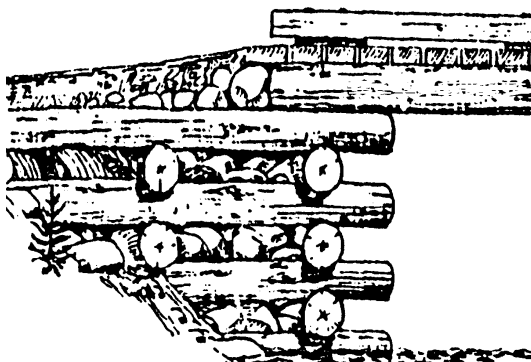
- Minimum acceptable bridge width is 10 feet.

- Firmly anchor
stable bank material



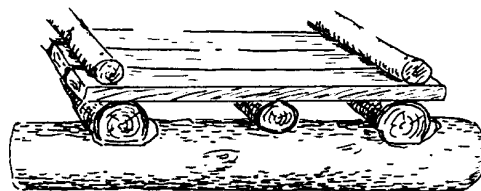
abutments out of the water in
and parallel to the stream

channel. Do not narrow stream channel with abutments.



- Acceptable abutment materials can be rock, logs, sawn timbers or a combination of any of the above. (See Logging and The Law)

- Place abutment aprons or approaches as close to gradient of bridge surface as possible. Avoid abrupt rises and drops from bridge gradient to apron gradient. (See Logging and The Law)
- Stringer material may be either logs, sawn timbers or steel.
- Match center line gradients of span and stringers with that of the road or trail.
- It is recommended that a registered engineer be contacted to design the bridge.
- Log stringers should have a flat upper bearing face to accept a plank deck as well as a flat bearing surface on abutments. Placement of log stringers on abutments should alternate small and large ends.
- Deck material shall be placed perpendicular to the stringer direction and be tight.
- A curb shall be installed along the outer sides of the deck and be fastened tight to the deck. Minimum size will be 6" x 6" and will run the entire length of the span. Pole timbers can also be used, but must be straight and of sound quality.
- The bridge must be anchored so that it will not wash out during high water.
- Old trailer beds make excellent temporary bridges over small streams.
- Placement of bridges that require work in the stream should be done when the water level is low and in as short a period of time as possible. (See Logging and The Law)
- Do not gravel the deck. The gravel holds moisture that will cause the deck to rot.
- When the harvesting operation has been completed, stabilize the area by removing all bridges from truck haul roads and skid trails which will not be maintained.
- Road and trail grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the watercourse. (See Erosion Control Devices)
- Find stream banks that are firm and level and approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.



STONE FORDS

☐ **Definition:**

Stream crossing using the stable stream bottom or stone fill as the roadbed.

☐ **Purpose:**

To be used on a truck haul road as a stream crossing rather than a bridge or culvert.

☐ **Conditions Where Practice Applies:**

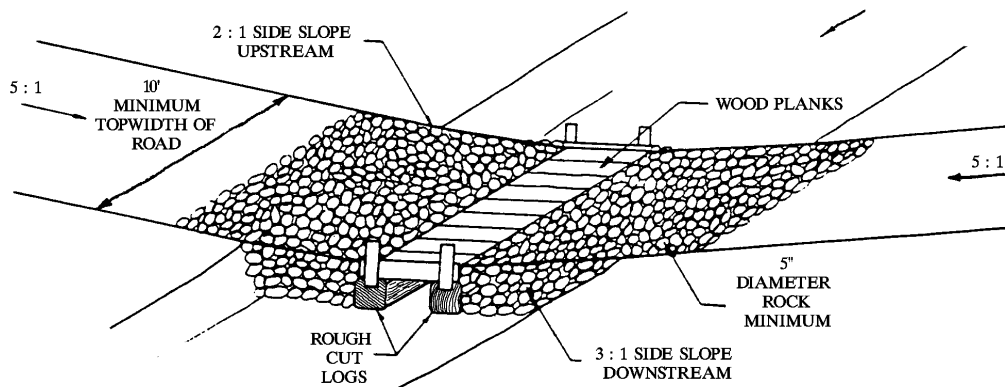
Perennial Stream Ford – Can be constructed and used during periods of low flow. When drainage area exceeds one square mile, a log box culvert should be installed.

Guidelines:

- Installation of fords is permissible only when it is not feasible to construct a bridge or install a pipe culvert, i.e. streams having no or low banks.
- Fords are prohibited on all streams in watersheds tributary to drinking water intakes or reservoirs for public and private water supplies, where the ford is within 2,000 feet of such intake or reservoir.
- Shall not be crossed when they are overtopped with water.
- **Skidding across stone fords is prohibited.**
- Construct on sound stable stream bottoms, whenever possible.
- Use geo-textile fabric or other appropriate bedding for approaches. Do not use in stream.
- Use angular rock fill material of at least 75% greater than 5 inches in diameter. Use larger sizes for large drainage areas.
- Use 2 inch round stone on surface of ford to protect tires from sharp edges of angular rock.
- Height of fill should be at least 1/2 foot above low flow water level. However, total fill should not to exceed 2 feet above stream bottom.
- The top width of the fords should be at least 10 feet.
- Side slopes of fords should be greater than or equal to; 2:1 upstream and 3:1 downstream.
- After fords have been overtopped with water, repair and maintenance will be required.

- Do not place gravel or fill on the top of stone fords.
- The log box culvert may float during overtopping and should be anchored.
- Large stones or boulders on the downstream face of a stone ford will increase its life.
- Roads and trail grades approaching stream crossings shall be broken and surface water dispersed so it will not reach the stream. (See Erosion Control Devices)
- Find stream banks that are firm and level with approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.

Number of 15"x15" Log Box Culverts	Drainage Area (Square Miles)	
	Shallow/High Elevation Soils	Normal Soils
1	1 - 5	1 - 8
2	5 - 10	8 - 17
3	10 - 15	17 - 20
4	15 - 20	



POLED FORDS

☐ **Definition:**

Temporary stream crossing in a defined channel using poles or cull logs as the roadbed.

☐ **Purpose:**

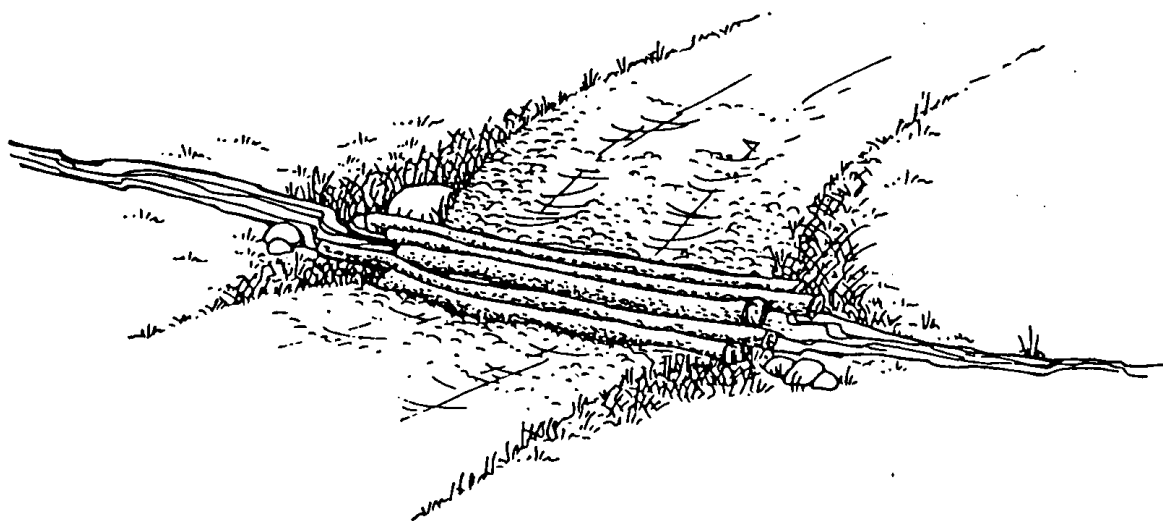
To be used as a stream crossing rather than a bridge or culvert.

☐ **Conditions Where Practice Applies:**

Can be constructed and used during periods of no or low flow. Fords are used for crossing streams with light use truck haul roads and skid trails where there is limited potential for sedimentation of the stream.

Guidelines:

- Installation of fords is permissible only when it is not feasible to construct a bridge or install a pipe culvert, i.e. streams having no or low banks.
- Fords are prohibited on all streams in watersheds tributary to drinking water intakes or reservoirs for public and private water supplies, where ford is within 2,000 feet of such intakes or reservoir.
- Shall not be crossed when they are overtopped with water.
- Constructed on sound stable stream bottoms.



- Use geo-textile fabric or other appropriate bedding if needed to stabilize the approaches to the crossing.
- Find stream banks that are firm and level with approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.
- Place 8 - 10 inch diameter poles or cull logs side by side on the stream bed to serve as the roadbed.
- The top width of these fords should be at least 10 feet.
- Poles and logs must be removed immediately after use.
- After fords have been overtopped with water, repair and maintenance will be required.
- Poled fords should be inspected regularly to make sure the stream is not becoming turbid.
- Do not gravel or fill over poled fords.



STREAM CULVERTS

☐ **Definition:**

Corrugated pipe, well casing, dredge pipe or wooden box culvert placed under a truck haul road or major skid road to permit crossing of an intermittent or live stream.

☐ **Purpose:**

To transmit water flow of intermittent or live streams under truck haul roads and major skid trails. To carry a single lane haul road or skid trail over a stream to enable more direct routing while keeping equipment and products out of the water.

☐ **Conditions Where Practice Applies:**

Where restrictions such as topography or property lines make it necessary to cross a stream. Stream crossings are a major concern in the construction and use of truck haul roads, major skid roads, and skid trails because of the potential for large amounts of sediment to enter a stream.

Guidelines:

- Keep the number of stream crossings to a minimum.
- Culvert size selection should be based on the size of the drainage area of a forested watershed and should be able to handle the largest stream flows.
- Estimate drainage area by taking measurements on a USGS topographic map, using contour lines to define the drainage limits. The Natural Resource Conservation Service can assist you with determination of drainage area.
- Install a culvert/emergency spillway when the expected life of the stream crossing is greater than the duration of the harvesting operation.
- Construct during periods of no or low flow and in as short a period of time as possible.
- Install culvert crossing at right angle to the stream. A maximum of 15 degree skew is allowed as an exception where approach conditions are difficult.
- Align approach and exit with culvert crossing center line with as little curvature as possible.
- Road and trail grades approaching stream crossings should be broken and surface water dispersed so it will not reach the watercourse. (See Erosion Control Devices)

SIZING PIPE CULVERTS FOR STREAM CROSSINGS

Acres of Drainage

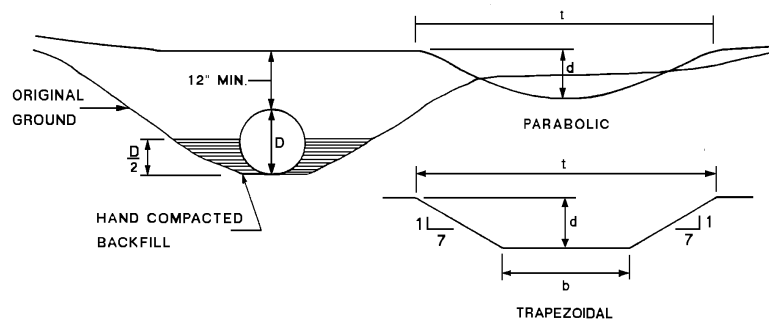
Shallow and High Elevation Soils	Normal Forest Soils	Recommended Pipe Culvert Diameter in Inches
2	9	12
4	16	15
7	25	18
12	40	21
16	55	24
27	84	30
47	130	36
64	190	42
90	260	48
120	335	54
160	400	60
205	550	66
250	640	72

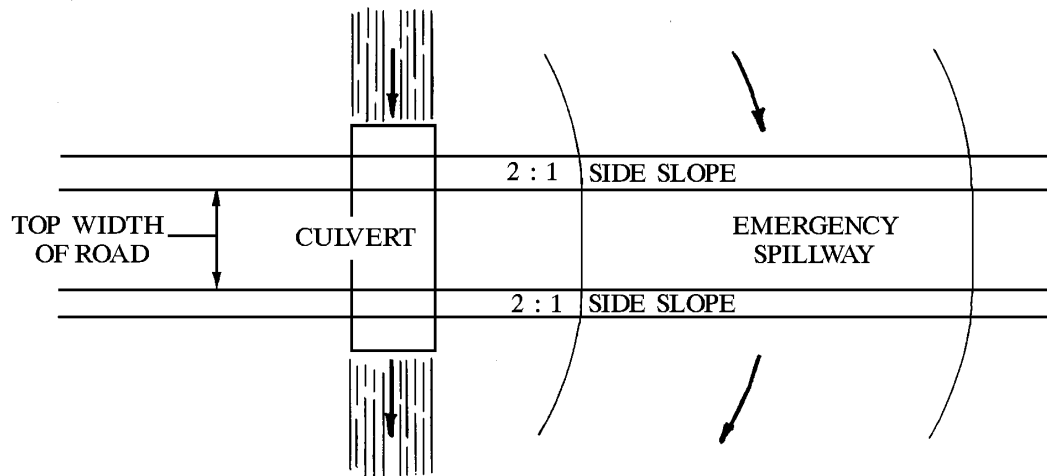
- Stream alignment should be straight at the point of crossing and of uniform profile so as not to obstruct the flow of water.
- Find stream banks that are firm and level and approaches that are reasonably level for a distance of 50 feet on each side of the stream crossing.
- Minimum acceptable culvert crossing top width is 10 feet.
- Place culverts in the natural drainage channel.
- Place culverts on the same grade as the stream bed. The minimum culvert grade is 2-4%.

Pipe Culvert Diameter in Inches	Suggested Emergency Spillway Dimensions				
	Parabolic (ft.)		Trapezoidal (ft.)		
	d	t	d	t	b
12	0.5	12.0	0.5	11.5	4.5
15	0.5	12.0	0.5	11.5	4.5
18	0.5	17.0	0.5	15.0	8.0
21	0.75	12.0	0.75	13.5	3.0
24	0.75	22.0	0.75	19.5	9.0
30	1.0	23.0	1.0	22.5	8.5
36	1.0	33.0	1.0	29.0	15.0
42	1.0	44.0	1.0	36.0	22.0
48	1.0	55.0	1.0	44.0	30.0
54	1.5	45.0	1.5	44.0	24.0
60	1.5	52.0	1.5	48.5	27.5
66	2.0	49.0	2.0	54.0	26.0
72	2.0	55.0	2.0	58.0	30.0

Design Assumptions:

- Entire drainage is forested
- Culverts sized for (2) year storm flow
- Emergency spillway sized for (10) year storm flow
- Inlet should be located on or below the stream bed, not above it.
- Avoid placing fill under the culvert to obtain the desired grade.





- Seat the culvert(s) and pack with clean washed stone; fill to half the diameter of the culvert and hand tamp.
- Cover culvert with a minimum of (1) foot of clean stone material or one-half the culvert diameter, whichever is greater. If adequate cover cannot be achieved, then (2) smaller culverts should be installed.
- Allow inlet and outlet ends of the culvert to extend at least (1) foot beyond the toe of the fill.
- Protect the upstream end of the fill around the culvert from erosion by placement of a rock header.
- Protect the downstream end of the fill around the culvert from erosion by seeding and mulching and providing riprap.



HAUL ROAD, SKID TRAIL, AND LOG LANDING STABILIZATION

☐ **Definition:**

Planting vegetation such as grasses and legumes on exposed mineral soil and erodible segments of truck haul roads, skid trails, or log landings.

☐ **Purpose:**

To permanently stabilize the site; to reduce damages from sediment and runoff, provide wildlife food value and habitat; enhance natural beauty; maintenance of the right-of-way is desired.

☐ **Conditions Where Practice Applies:**

Areas of exposed mineral soil that are subject to erosion and where a permanent vegetative cover is needed.

Guidelines:

- Old or new water diversion structures such as water bars, culverts, broad based dips, etc., must be operative before stabilization is initiated.
- Where feasible, prepare a seedbed by grading, removing debris, and scarifying the soil to a minimum depth of 3 inches. When the area to be seeded has been recently loosened to the extent that an adequate seedbed exists, no additional treatment is required.
- Lime and fertilizer should be thoroughly applied to the seedbed as indicated by soil test.
 1. Lime to a pH of 6.0, but in the absence of a soil test, apply a minimum of 2 ton/acre of ground agricultural limestone (high magnesium).
 - 2 Fertilize at the rate of 500 pounds of 10-10-10 per acre.
- Mulch, such as straw, hay, woodchips, or bark, retains soil moisture, important for seed germination, and protects the soil surface from erosion due to runoff. Mulch can be used to: (1) promote natural revegetation or (2) protect seeds that have been spread over an area. If you seed, apply mulch immediately afterward.
- Seeded areas should be closed off from all use until cover is adequately established.
- Inspect all seeded areas for failures and make necessary repairs.

- Grasses and other herbaceous cover can stabilize bare mineral soil and minimize erosion. It is a good practice to seed disturbed areas following harvesting.
- Close off vehicle access with a gate, fence, boulders, or with a large tree felled across the road.
- Mulch seedings and anchor on slopes or where subjected to concentrated flow.
- Track in seed with a dozer whenever possible to improve germination and establishment, especially when seeding flatpea or crownvetch and on sandy, droughty sites.

Seeding Mixtures for Permanent Seedings¹

<u>Area/Purpose</u>	<u>Drainage Class</u>	<u>Soil pH</u>	<u>Shade</u>	<u>Appropriate Mixture² (lbs./Ac)</u>	
Winter Roads	Poorly	5.0-7.5	Moderate	Reed Canarygrass	15
Landings			to	Birdsfoot Trefoil	10 ³
Wildlife			None	Redtop	2
Roads	Excessively to Somewhat	4.5-7.5	Heavy	Creeping Red Fescue	20
Trails			to	Tall Fescue	20
Landings			None	Redtop	2
Burned Over					
Roads	Excessively to Somewhat	5.5-7.5	Moderate	Flatpea	20 ³
Trails			to	Tall Fescue	15
Landings			None	Redtop	2
Burned Over					
Brush Control					
Roads	Well to Moderately	5.0-7.5	Moderate	Creeping Red Fescue	20
Landings			to	Birdsfoot Trefoil	8 ³
Wildlife			None	Redtop	2
Roads	Well to Moderately	5.5-7.5	Moderate	Crownvetch	15 ³
Landings			to	Tall Fescue	15
Wildlife			None	Creeping Red Fescue	10
				Redtop	2

¹Seeding Dates. Seed disturbed areas as soon as possible. Seed early in the spring as soon as the ground can be worked and in the late summer - early fall based on local recommendations.

²Include 10-20 lbs./ac. of winter rye when seeding after Sept. 15th. On critical areas or droughty sites, apply hay or straw mulch at the rate of 90 lbs./1000 sq. ft. Anchor mulch on steep slopes or where subjected to concentrated flow.

³Inoculate legumes separately with an inoculant which is specifically recommended for the legume being seeded.

Seeding Mixtures for Temporary Seedings¹

For Excessively Well to Somewhat Poorly Drained Soils

<u>Area/Purpose</u>	<u>Soil pH</u>	<u>Shade</u>	<u>Appropriate Mixture²(lbs./Ac.)</u>	
Roads	4.5-7.5	Heavy to None	Creeping Red Fescue	40
Trails			Redtop	2
Landings				
Burned Over				
Roads	5.5-7.5	Heavy to None	Annual Ryegrass	40
Trails				
Landings				
Roads	5.5-7.5	Moderate to None	Winter Rye	112
Trails				
Landings				
Wildlife				

¹Seeding Dates. Seed disturbed areas as soon as possible. Seed as early in the spring as the ground can be worked and in the late summer - early fall based on local recommendations.

²On critical areas or droughty sites, apply hay or straw mulch at the of 90 lbs./1000 sq. ft. Anchor mulch on steep slopes or where subjected to concentrated flow.



LOGGING AND THE LAW

CHAPTER 227-JTIMBER HARVESTING

227-J:1 Declaration of Purpose. It is hereby recognized and declared that the public welfare of this state requires the care and protection of forest cover adjacent to certain waters of the state and along public highways, and the proper disposal of slash and mill residue resulting from forest operations in certain circumstances to help conserve the amount and quality of surface waters and groundwaters of the state; reduce the incidence and severity of forest fires; promote healthful surroundings, recreational opportunities, and scenic values; ensure future forest productivity; improve conditions for wildlife; and provide other benefits to the public as the result of perpetuating a proper forest cover, while continuing to meet the timber needs of forest industries and providing income and employment for our citizens without undue infringement on the rights of private forest landowners.

227-J:2 Duties and Authority of the Director, Division of Forests and Lands:

- I. The director, or the director's authorized agents shall:
 - (a) Be the primary enforcement agency for this chapter.
 - (b) Enforce the provisions of RSA 637 insofar as they pertain to the protection and improvement of forestlands.
- II. The director or the director's authorized agents may:
 - (a) For the purpose of performing the duties under this chapter, enter upon all lands in this state, posted or otherwise.
 - (b) Exercise the powers of arrest pursuant to RSA 227- G:7.
 - (c) Issue a written cease and desist order against any timber operation in violation of this chapter, with the exception of RSA 227-J:4. Any such violation may be enjoined by the superior court, upon application of the attorney general. A person failing to comply with the cease and desist order shall be guilty of a violation.
 - (d) Issue cease and desist orders to temporarily suspend logging or other operations in forest areas when the director determines that such actions have resulted in, or are likely to result in, pollution of surface water or groundwater. In such instances, the director shall immediately notify the division of water supply and pollution control, which shall investigate at once. The cease and desist order issued by the director shall remain in force until such time as the division of water supply and pollution control determines whether the action in question constitutes a threat to water supplies.

- III. The director may enter into cooperative agreements or memoranda of understanding for the enforcement of the provisions of this chapter.

227-J:6 Operations in Wetlands.

- I. Pursuant to RSA 482-A no person shall excavate, remove, fill, dredge or construct any structures in or on any bank, flat, marsh, or swamp in and adjacent to any waters of the state without a permit from the wetlands board. Failure to comply with these requirements may result in penalties under RSA 482-A.
- II. Pursuant to RSA 482-A:3, V, persons who have complied with notice of intent to cut wood requirements under RSA 79:10, and who have filed an appropriate notification of forest management activities having minimum wetlands impact with the wetlands board and the department, shall have satisfied the permitting requirements for minimum impact activities.
- III. Pursuant to the rules of the wetlands board, skid trails, truck roads and culverts, bridges, pole fords or other crossings on the skid trails or truck roads shall be constructed in accordance with procedures as currently cited in the Best Management Practices for Erosion Control on Timber Harvesting Operations in New Hampshire, published by the department.

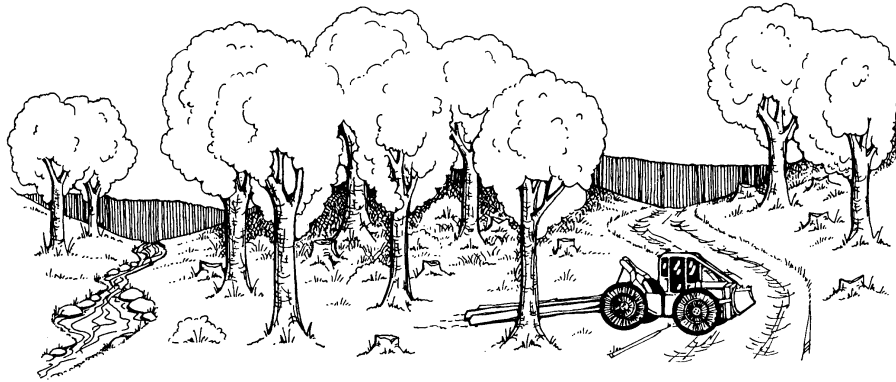
227-J:7 Alteration of Terrain.

- I. Pursuant to RSA 485-A:17, any person proposing to dredge, excavate, place fill, mine, transport forest products or undertake construction in or on the border of the surface waters of the state, and any person proposing to significantly alter the characteristics of the terrain, in such a manner as to impede the natural runoff or create an unnatural runoff shall comply with the provisions of RSA 485-A. Failure to comply with these requirements may result in penalties under RSA 485-A.
- II. Permits are obtained by signing the intent to cut form as provided in RSA 485-A:17, III.

227-J:9 Cutting of Timber Near Certain Waters and Public Highways of the State; Penalty.

- I. No more than 50 percent of the basal area of trees shall be cut, or otherwise felled, leaving a well distributed stand of healthy, growing trees, within 150 feet of any great pond, any other standing body of water 10 acres or more in area, fourth order stream or higher, or public highway or within 50 feet of any other stream, river or brook which normally flows throughout the year, or standing body of water less than 10 acres in size associated with a stream, river or brook which normally flows throughout the year, unless the person who pushes over, cuts, saws, or operates on or causes to be pushed, cut, sawed, or operated on said trees, obtains the prior written consent of the director or the director's agents in accordance with paragraph V.
- II. Timber cutting for land conversion purposes, other than timber growing and forest uses, shall be exempt from this section if those persons intending to convert the use of the land have secured all required local permits including, but not limited to, building, subdivision or zoning permits,

excavation permits, or site plan approval necessary for the use to which the land will be converted, and are able to furnish proof of such permits.

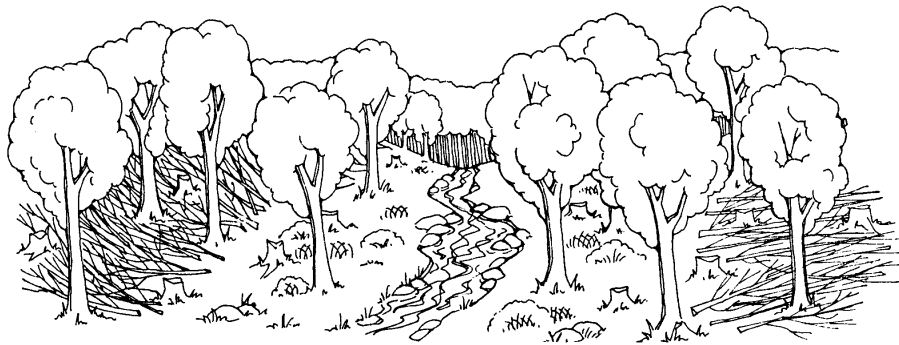


- III. No person shall clear land of natural vegetation on a given lot, tract, or parcel proposed for subdivision pursuant to RSA 485-A:32, unless such subdivision plan has been submitted and approved in accordance with the requirements of RSA 485-A.
- IV. Timber cutting for land conversion purposes, other than timber growing and forest uses, that does not require any local permits shall be exempt from this section if conversion occurs within 180 days of exceeding the provisions in paragraph I, or there has been prior written consent to extend the 180-day period from the director or the director's agents in accordance with paragraph V.
- V.
 - (a) Before the director grants a request to exceed the limits established in this section, the landowner or authorized agent shall demonstrate that it is necessary to exceed such limits and that any and all actions are consistent with the purposes of this chapter. The director shall provide a standard request form for this purpose. This form shall be submitted to the director or the director's agents at least 30 days prior to commencing the timber cutting operation.
 - (b) Failure of the division to act upon the request within 30 days shall serve as automatic approval.
- VI.
 - (a) Any person who violates the provisions of this section shall be guilty of a misdemeanor.
 - (b) Each 200 linear feet or fraction thereof of frontage on the affected great pond, any standing body of water 10 acres or more in area, fourth order stream or higher, or public highway, or any other stream, river or brook which normally flows throughout the year or standing body of water less than 10 acres in size associated with a stream, river or brook which normally flows throughout the year, from which trees are cut in excess of limits prescribed in this section shall constitute a separate offense.
- VII. This section shall be enforceable by the municipality in which the land is situated; provided, however, that before initiating any enforcement action, the municipality shall notify the director, who

shall take action to the extent the director deems necessary to ensure uniform statewide enforcement. If, within 10 days of notification to the director, no enforcement action has been taken by the director or the director's agent, the municipality may proceed with actions necessary to ensure compliance with the law.

- VIII Forest management not associated with shoreland development nor land conversion and conducted in compliance with the provisions of this section shall be exempt from the provisions of RSA 483-B.

227-J:10 Care of Slash and Mill Residue; Penalty. Whoever pushes over, cuts, saws or operates on or causes to be pushed over, cut, sawed or operated on any timber, brush, lumber, or wood shall dispose of the slash and mill residue caused by such action so that slash and mill residue shall not remain:



- I. In any stream, river, or brook which normally flows throughout the year or in any other standing body of water, public highway, or active railroad bed.
- II. On the property of another, or in a cemetery.
- III. Within 25 feet of land of another, or fourth order stream.
- IV. Within 50 feet of any great pond, any standing body of water 10 acres or more in area, public highway, or active railroad bed.
- V. Within 100 feet of any occupied structure as defined in RSA 635:1, III, including all barns, sheds, and other storage buildings, except a temporary lumber camp.
- VI. Disposal of slash and mill residue shall be in such manner that it is disposed of within the area between 50 feet and 150 feet of any great pond, standing body of water 10 acres or more in area, or public highway so it lies on the ground and no part of the slash or residue extends more than 4 feet above the ground.

- VII. If more than one of the limitations in paragraphs I-VI on the disposal of slash and mill residue shall be applicable, the most restrictive shall control.
- VIII Any person who pushes over, cuts, saws or operates on or who causes to be pushed over, cut, sawed or operated on any such timber, brush, lumber or wood, or any owner of land where cutting is done, shall be guilty of a misdemeanor for each 200 linear feet or fraction thereof of property boundaries, water frontage, public highway and railroad frontage from which the slash and mill residue is not properly removed or disposed of as provided under RSA 227-J:10, I-VII, within 30 days after such cutting unless an extension is approved by the director. If the person refuses or neglects to properly remove or dispose of the slash or mill residue within the time prescribed, the person shall be guilty of a misdemeanor as provided in this paragraph for each subsequent 30-day period of refusal or neglect to so remove or dispose of such slash or mill residue.

227-J:14 Administrative Fines.

- I. The director, with the approval of the commissioner and after notice and hearing pursuant to RSA 541-A, may impose an administrative fine not to exceed \$2,000 for each offense upon any person who violates any provision of this chapter. Rehearings and appeals from a decision of the commissioner under this paragraph shall be in accordance with RSA 541. Any administrative fine imposed under this section shall not preclude the imposition of further penalties under this chapter. The commissioner shall adopt rules, under RSA 541-A, relative to:
- (a) A schedule of administrative fines which may be imposed under this paragraph for violation of this chapter.
 - (b) Procedures for notice and hearing prior to the imposition of an administrative fine.
- II. The proceeds of administrative fines levied pursuant to paragraph I shall be deposited by the commissioner into the forest management and protection fund established under RSA 227-G:5, I.

WETLANDS PERMITTING

Timber harvests which involve stream or wetland crossings require a wetlands permit. The level of harvesting impacts on a wetland dictates the type of wetland permit required. There are three types of actions: minimum, minor, and major.

MINIMUM IMPACT WETLANDS PERMIT

The minimum impact wetlands permit is attached to the intent to cut form. A minimum impact wetlands permit is only allowed under the following circumstances:

- Forest management harvests only - land conversion projects require a separate dredge and fill permit;
- Wetland impacts of less than 3,000 square feet;
- Permanent culverts or rock fords which do not exceed 15 feet in width and 50 feet in length;
- Stream crossings up to 10 feet in width;
- Wetland crossings of up to 50 feet in width.

To complete the minimum impact wetlands permit, simply fill in the one page questionnaire, prepare a map of the harvest area using a USGS topographic map showing all wetland crossings and pay an additional fee of \$25. Forest harvesting can begin as soon as local officials sign the intent to cut.



EXCAVATING AND DREDGING PERMIT

If the timber harvest has minimum impacts but the land is being converted to other than non-forest uses, or if a logging operation will result in wetland impacts greater than those described above, a dredge and fill permit from the New Hampshire Wetlands Bureau will be required. Applications for these permits are available at town and county conservation district offices. Permit applications, a detailed plan, proof of notification of abutters and fees based on the square footage of impacted wetlands are required. When the application and accompanying materials are submitted to the Bureau, four copies of each must also be provided to the town clerk. The town clerk keeps one and sends the other copies to the selectmen, planning board, and conservation commission. Town clerks may charge an administrative fee of up to \$10.

RSA 482-A:3 Excavating And Dredging Permit; Certain Exemptions

- I. No person shall excavate, remove, fill, dredge or construct any structures in or on any bank, flat, marsh, or swamp in and adjacent to any waters of the state without a permit from the wetlands board. The permit application together with a detailed plan and a map showing the exact location of the proposed project, along with 4 copies of the permit application, plan and map, shall be submitted to the town or city clerk, accompanied by a filing fee in the form of a check made out by the applicant to the New Hampshire wetlands board. The permit application fee shall be \$50 for minimum impact projects. Fees for minor and major projects shall be assessed based on the area of dredge or fill proposed and the number of boat slips requested. The rates shall be \$100 per boat slip and \$0.025 per square foot. At the time the permit application is submitted to the city or town clerk, the applicant shall provide postal receipts or copies, verifying that abutters, as defined in the rules of the wetlands board, and except as further provided in said rules, have been notified by certified mail. The postal receipts or copies shall be retained by the municipality. The town or city clerk shall immediately sign the application and forward by certified mail, the application, plan, map and filing fee to the wetlands board. The town or city clerk shall then immediately send a copy of the permit application, plan and map to the local governing body, the municipal planning board, if any, and the municipal conservation commission, if any, and may require an administrative fee not to exceed \$10 plus the cost of postage by certified mail. One copy shall remain with the city or town clerk, and shall be made reasonably accessible to the public. The foregoing procedure notwithstanding, applications and fees for projects by agencies of the state may be filed directly with the wetlands board, with 4 copies of the application, plan and map filed at the same time with the town or city clerk to be distributed as set forth above.

MINIMUM SHORELAND PROTECTION STANDARDS

RSA 483-B:9

- V. The following minimum standards shall apply to the protected shoreland provided that forestry, involving water supply reservoir watershed management or agriculture conducted in accordance with best management practices, shall be exempted from the provisions of this chapter:

(a) Natural Woodland Buffer

- (1) Where existing, a natural woodland buffer shall be maintained within 150 feet of the reference line. The purpose of this buffer shall be to protect the quality of public waters by minimizing erosion, preventing siltation and turbidity, stabilizing soils, preventing excess nutrients and chemical pollution, maintaining natural water temperatures, maintaining a healthy tree canopy and understory, preserving fish and wildlife habitat, and respecting the overall natural condition of the protected shoreland.
- (2) Within the natural woodland buffer of the protected shoreland under conditions defined in RSA 483-B:9,V the following prohibitions and limitations shall apply:
 - (A) Not more than a maximum of 50 percent of the basal area of trees, and a maximum of 50 percent of the total number of saplings shall be removed for any purpose in a 20-year period. A healthy, well-distributed stand of trees, saplings, shrubs and ground covers and their living, undamaged root systems shall be left in place.
 - (B) [REPEALED 1992, 235:28, I.]
 - (C) Trees, saplings, shrubs and ground covers which are removed to clear an opening for building construction, accessory structures, septic systems, roadways, pathways, and parking areas shall be excluded when computing the percentage limitations under subparagraph (a)(2)(A).
 - (D) Dead, diseased, unsafe, noxious or fallen trees, saplings, shrubs, or ground cover may be removed. Their removal shall not be used in computing the percentage limitations under subparagraph (a)(2)(A).
 - (E) Stumps and their root systems which are located within 50 feet of the reference line shall be left intact in the ground.
 - (F) Dead and living trees that provide dens and nesting places for wildlife are encouraged to be preserved.
 - (G) Planting efforts that are beneficial to wildlife are encouraged to be undertaken.

ALTERATION OF TERRAIN

An alteration of terrain permit application must be filed if the harvest is being done to clear and stump land for non-forest uses. The permit is required if and more than 100,000 square feet (a little more than 2 acres) or 50,000 square feet in the shoreland protection zone (RSA 483-B:9, V) of land are affected. Alteration of Terrain permits are available at county conservation district offices and the Water Supply and Pollution Control Division of the New Hampshire Department of Environmental Services (DES).

485-A:17 Terrain Alteration

- I. Any person proposing to dredge, excavate, place fill, mine, transport forest products or undertake construction in or on the border of the surface waters of the state, and any person proposing to significantly alter the characteristics of the terrain, in such a manner as to impede the natural runoff or create an unnatural runoff, shall be directly responsible to submit to the division detailed plans concerning such proposal and any additional relevant information requested by the division, at least 30 days prior to undertaking any such activity. The operations shall not be undertaken unless and until the applicant receives a permit from the division. The division shall have full authority to establish the terms and conditions under which any permit issued may be exercised, giving due consideration to the circumstances involved and the purposes of this chapter, and to adopt such rules as are reasonably related to the efficient administration of this section, and the purposes of this chapter. Nothing contained in this paragraph shall be construed to modify or limit the duties and authority conferred upon the division of water resources under RSA 482 and RSA 482-A.
- II. The division shall charge a fee for each review of plans, including project inspections, required under this section. The fee shall be based on the extent of contiguous area to be disturbed. Except for RSA 483-B:9, the fee for plans encompassing an area of at least 100,000 square feet but less than 200,000 square feet shall be \$100. For the purposes of RSA 483-B:9, the fee for plans encompassing an area of at least 50,000 square feet but less than 200,000 square feet shall be \$100. An additional fee of \$100 shall be assessed for each additional area of up to 100,000 square feet to be disturbed. No permit shall be issued by the division until the fee required by this paragraph is paid. All fees required under this paragraph shall be paid when plans are submitted for review and shall be deposited in the treasury as unrestricted funds.
- III. Normal agricultural operations shall be exempt from the provisions of this section. The division may exempt other state agencies from the permit and fee provisions of this section provided that each such agency has incorporated appropriate protective practices in its projects which are substantially equivalent to the requirements established by the division under this chapter. Timber harvesting operations shall be exempt from the provisions of this section. Permits shall be granted for timber harvesting operations provided that the department of revenue administration's intent to cut form is completed.

485-A:32 Prior Approval; Permits

- III. No person required to submit subdivision plans pursuant to paragraph I shall commence the construction of roads within the lot, tract or parcel proposed to be subdivided, by clearing the land thereof of natural vegetation, placing any artificial fill thereon, or otherwise altering the land, nor shall he do any other act or acts which will alter the natural state of the land or environment, unless the subdivision plan relating thereto has been submitted and approved in accordance with the requirements of this chapter. Nothing in this paragraph shall be construed to prevent the taking of test borings, the digging of test pits, or any other preliminary testing and inspection necessary to comply with the requirements of the division of water supply and pollution control relative to information necessary for review and approval of the subdivision plans.

AVAILABLE ASSISTANCE

Division of Forests and Lands

Department of Resources and Economic Development

Post Office Box 1856

Concord, New Hampshire 03302-1856

(603) 271-2214

North Country Resource Center
RFD #2 - Box 241 - Route 3
Lancaster, New Hampshire 03584
788-4157

South Region Headquarters - Fox Forest
PO Box 1175 - School Street
Hillsborough, New Hampshire 03244
464-3453

Central Region Hdqtrs. - Forest Nursery
405 Daniel Webster Highway
Boscawen, New Hampshire 03303
796-2323

Urban Forestry Center
45 Elwyn Road
Portsmouth, New Hampshire 03801
431-6774

Department of Environmental Services

Health and Human Service Building

6 Hazen Drive - PO Box 95

Concord, New Hampshire 03302-0095

(603) 271-3503

Water Supply & Pollution Control Division
Health and Human Service Building
6 Hazen Drive - PO Box 95
Concord, New Hampshire 03302-0095
271-3504

Water Resources Division
64 North Main Street
Concord, New Hampshire 03301-4913
271-3406

Wetlands Bureau
Health and Human Service Building
6 Hazen Drive - PO Box 95
Concord, New Hampshire 03302-0095
271-2147

University of New Hampshire - Cooperative Extension

Cooperative Forestry Programs

Pettee Hall

Durham, New Hampshire 03824

862-1028

Belknap County

Beacon Street East

Box 368

Laconia, New Hampshire 03246

524-1737

Hillsborough County

Chappell Prof. Center

468 Route 13 South

Milford, New Hampshire 03055

673-2510

Carroll County

34 Main Street

P.O. Box 367

Conway, New Hampshire 03818

447-5922

Merrimack County

327 D.W. Highway

Boscawen, New Hampshire 03303

796-2151 or 225-5505

Cheshire County

33 West Street

Keene, New Hampshire 03431

352-4550

Rockingham County

113 North Road

Brentwood, New Hampshire 03833

679-5616

Coos County

North Country Resource Center

RFD#2, Route 3

Lancaster, New Hampshire 03584

788-4961

Strafford County

259 County Farm Road, Unit 5

Dover, New Hampshire 03820

749-4445

Grafton County

Grafton County Courthouse

RR 1, Box 65F

North Haverhill, New Hampshire 03774

787-6944

Sullivan County

24 Main Street

Newport, New Hampshire 03743

863-9200

Natural Resources Conservation Service

Federal Building - Madbury Road
Durham, NH 03824
868-7581

Claremont Field Office

25 Mulberry Street
Claremont, New Hampshire 03743-2539
542-6681

Keene Field Office

U.S. Postal Service Building
196 Main Street
Keene, New Hampshire 03431-3765
352-3602

Concord Field Office

The Concord Center
10 Ferry Street, Box 312
Concord, New Hampshire 03301-5081
225-6401

Lancaster Field Office

RR2, Box 235
Lancaster, New Hampshire 03584-9612
788-4651

Conway Field Office

44 Main Street
PO Box 533
Conway, New Hampshire 03818-0533
447-2771

Milford Field Office

Chapell Professional Center
#468, Route 13, South
Milford, New Hampshire 03055-3442
673-2409

Dover Field Office

USDA Agriculture Service Center
259 County Farm Road, Unit #3
Dover, New Hampshire 03820-6015
749-3037

Woodsville Field Office

Swiftwater Road
RR 2, Box 148-B
Woodsville, New Hampshire 03785-0229
747-2001

Epping Field Office

243 Calef Highway
Telly's Plaza
Epping, New Hampshire 03042
679-1587

New Hampshire Farm Service Agency

22 Bridge Street - PO Box 1388
Concord, New Hampshire 03302
(603) 224-7941

Cheshire County

NH Farm Service Agency
196 Main Street, Room 218
PO Box 464
Keene, New Hampshire 03431
352-2322

Coos / Carroll County

NH Farm Service Agency
RR #2, Box 235, Kidder Building
Lancaster, New Hampshire 03584
788-4602

Grafton County

NH Farm Service Agency
Swiftwater Road, RR 2, Box 148C
Woodsville, New Hampshire 03785
747-3751

Hillsborough County

NH Farm Service Agency
Chappell Professional Building
468 State, Route 13 South
Milford, New Hampshire 03055
673-1222

Merrimack / Belknap County

NH Farm Service Agency
10 Ferry Street, Box 22, Suite 212
Concord, New Hampshire 03301
225-5931

Rockingham / Strafford County

NH Farm Service Agency
243 Calef Highway
Route 125, Telly's Plaza
Epping, New Hampshire 03042
722-4384

Sullivan County

NH Farm Service Agency
25 Mulberry Street
Claremont, New Hampshire 03743
542-4281

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